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INTRODUCTION

Background

7.1 This chapter of the Environmental Impact Assessment (EIAR) provides a description of the water, including surface water (hydrology) and groundwater (hydrogeology), environment of the application area and the surrounding land. The baseline surface water and groundwater environment conditions are identified and described, and the potential effects of the proposed development on surface and groundwater are assessed and if required, mitigation measures are prescribed.

7.2 The assessment presented in this chapter is based on publicly available desktop environmental information for the site and the ongoing water related monitoring by Kilsaran.

7.3 Kilsaran previously applied for planning permission for sand and gravel extraction at this site in 2019 (P. Reg. Ref. No: AA191263). Following a Request for Further Information (RFI) Meath County Council issued a notification to grant permission in July 2020. As a result of a 3rd party appeal, An Bord Pleanála refused this permission in 2021 (Ref. No. ABP-308009-20).

7.4 The main water related reasons for refusal was the Board's view that the proposed development may result in significant effects on groundwater and surface water quality in the vicinity of the site and may impact flows within the Delvin River which could lead to an increased downstream flood risk. Key concerns raised in relation to surface water included:

- Potential effects on surface water quality associated with the migration of contaminants through the sand and gravel deposits to the Delvin River;
- Concerns relating to the uncertainties associated with the proposed cut-off drain and the previously proposed settlement ponds (revised settlement ponds form part of the current application);
- Potential effects on surface water quantity associated with a risk of increased baseflow to the River Delvin and an associated increase in the downstream flood risk; and,
- Potential effects associated with the proposed internal haul road.

Key concerns in relation to groundwater included:

- Potential effects on groundwater quality in the bedrock aquifer from suspended solids and accidental spills of contaminants;
- Potential effects on groundwater in the bedrock aquifer due to the removal of protective surface and subsurface layers (i.e. low permeability layers); and,
- Potential effects on local groundwater well supplies due to the absence of a comprehensive information on the likely movement of water and its connectivity to/relationship with wells in the area of the site.

7.5 The primary 3rd party concerns raised in relation to the previous application included:

- Potential effects on the underlying bedrock aquifer;
- Potential effects on local groundwater well supplies in the absence of an adequate well survey;
- Potential effects on the Delvin River; and,

- Potential effects on the WFD status of downstream surface waterbodies and the WFD status of the underlying groundwater bodies.

7.6 The above concerns raised in respect of the previous planning application have been comprehensively addressed in this EIAR. In response to the Board's previous reasons for refusal, Kilsaran have amended the proposed development and have prescribed detailed mitigation measures for the protection of water environment (surface water and groundwater) by way of the following below design amendments:

- The final floor level of the proposed pit has been amended to reflect the local hydrogeological regime and to reduce the works below the water table;
- The proposed development includes a phased operational phase whereby each of the 3 no. proposed extraction areas will be restored upon completion of the extraction in these areas (thereby reducing the area of exposed sand and gravels at any one time); and,
- The proposed development includes an aggregate washing plant which removes the requirement for large settlement ponds at surface (refer to Para 7.216).

7.7 The assessment completed for this EIAR chapter builds upon the EIAR submitted for the previous application at this site, and the associated response to the further information request, and addresses all water related issues raised previously by the Board, and 3rd parties.

7.8 Unmitigated potential effects on hydrology and hydrogeology are considered for the initial assessment, before appropriate mitigation measures for the potential impacts identified are discussed, and then the identified potential impacts are reassessed assuming the identified mitigation measures are in place.

7.9 Available information on the hydrology and hydrogeology of the Naul area and its surrounds has been collated and evaluated. See Chapter 2: Project Description for details of the site and a description of the proposed development.

Development Proposal

7.10 The proposed and amended development being applied for under this planning application comprises of:

- Extraction and processing on site, to include washing (with associated closed recycled washing plant and lagoon system), screening and crushing plant; storage; stockpiling and haulage of sand and gravel to service the existing readymix concrete plant operated by Kilsaran on the eastern side of the R108 regional road and permitted under P. Ref. 80/572 and 22/153 (ABP-314881-22);
- The total extraction proposal extends to an area of c. 6.2 hectares and will be worked (extracted and restored) on a phased basis for a period of 11 years plus 1 year to complete final restoration works (total duration of 12 years);
- Phased stripping and storage of topsoil and overburden materials for reuse in the restoration works. Restoration of the site will be to a beneficial agricultural after-use;
- Access to the site will be through the existing agricultural enterprise site entrance onto the R108 regional road with upgrade of same to consist of setting-back of the existing boundary wall to the north of the site access, and provision for the upgrade of the existing internal access track and section of a new access track which will include a new weighbridge; and
- All associated site ancillary works within an overall application area of c. 14.9 hectares.

7.11 The existing permitted concrete batching facility (P. Ref. 80/572 & P. Ref. 22/153 (ABP-314881-22) to the east of the R108 regional road does not fall within the red line planning application boundary. For the purposes of preparing a robust EIA assessment, the concrete batching plant is cumulatively assessed within the proposed extraction development where relevant.

7.12 The proposed development is detailed in full in Chapter 2 of this EIAR.

Scope of Work / EIA Scoping

7.13 The scope of this chapter includes:

- Characterisation of the existing baseline surface water (hydrological) and groundwater (hydrogeological) environment for the site and the surrounding area by collecting all relevant hydrological, hydrogeological meteorological data;
- An assessment of the potential effects of the proposed development on the hydrological and hydrogeological environment; and,
- Where necessary, mitigation measures are prescribed to reduce or eliminate any potential effects.

Consultations/ Consultees

7.14 As part of the previous planning application a pre-planning consultation meeting was held between officials of Meath County Council and the applicant on 2nd August 2019 at the offices of the Planning Authority. As the site is adjacent to the Meath Dublin border, pre-planning consultation was also carried out with Fingal County Council.

7.15 A further formal pre-planning meeting was held online with Meath Conty Council Planning Department on 30th May 2024.

Contributors / Author(s)

7.16 This chapter of the EIAR was prepared by Michael Gill and Conor McGettigan of Hydro-Environmental Services. Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. Our core areas of expertise and experience include hydrology and hydrogeology. We routinely complete environmental impact assessments for hydrology and hydrogeology for a large variety of project types including sand and gravel pits and bedrock quarries.

7.17 Michael Gill PGeo (BA, BAI, Dip Geol., MSc, MIEI) is a Civil/Environmental Engineer, Hydrologist and Hydrogeologist with 22 years' environmental consultancy experience in Ireland. Michael has a degree in Civil and Environmental Engineering, a MSc in Engineering hydrology from TCD and a MSc in Applied Hydrogeology from Newcastle University. Michael has completed numerous (60+) hydrological and hydrogeological assessments relating to bedrock quarries and sand and gravel pits. Recent examples include Ardfert quarry in County Kerry, Middleton Quarry in County Cork and Clonard Quarry in County Kildare.

7.18 Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 4 years' experience in the environmental sector. Conor holds an MSc in Applied Environmental Science and a BSc in Geology. Conor routinely completes hydrological and hydrogeological impact assessments for a variety of proposed developments including bedrock quarries, sand and gravel pits, renewable energy development, and residential/industrial developments.

Limitations / Difficulties Encountered

7.19 No limitations or difficulties were encountered during the preparation of this EIAR chapter.

REGULATORY BACKGROUND

Legislation

7.20 Refer to **Appendix 7-A** for a comprehensive list of legislation and guidelines.

7.21 This EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

7.22 In addition, the requirements of the following legislation is complied with:

- S.I. No. 349/1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84/1994, S.I. No. 101/1996;
- S.I. No. 351/1998, S.I. No. 93/1999, S.I. No. 450/2000 and S.I. No. 538/2001;
- S.I. No. 134/2013 and the Minerals Development Act 2017), the Planning and Development Act, and S.I. No. 600/2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/337/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law;
- S.I. No. 94/1997: European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293/1988: Quality of Salmon Water Regulations;
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of 'daughter' Groundwater Directive (2006/118/EC). . Since 2000 water management in the EU has been directed by the Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and

Commission Directive 2014/101/EU ("WFD"). The WFD was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003);

- S.I. No: 122/2010: European Communities (Assessment and Management of Flood Risks) Regulations, resulting from EU Directive 2007/60/EC;
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and,
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

Guidelines and Technical Standards

7.23 This chapter of the EIAR is carried out in accordance with the guidance contained in the following:

- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);
- Environmental Protection Agency (EPA) (May 2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (IGI) (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (NRA) (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Inland Fisheries Ireland (IFI) (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) (2006): Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors (CIRIA C532, 2006);
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018);
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017);
- Department of the Environment, Heritage and Local Government; Quarries and Ancillary Activities – Guidance for Authorities (April, 2014);
- Environmental Protection Agency (EPA) (2006): Environmental Management in the Extractive Industry (Non-Scheduled Minerals); and,
- Environmental Protection Agency (EPA) (1999): Wastewater Treatment Manuals – Treatment Systems for Small Communities, Business, Leisure Centres and Hotels.

Planning Policy and Development Control

7.24 The following Planning Policy and Development Control relating to water at the site in this EIAR is set out in the:

- Meath County Development Plan, 2021-2027.

7.25 The county development plan sets out conservation objectives in relation to the hydrological and hydrogeological environment.

Significant Risks

7.26 Potential significant risks arising from the proposed development which may impact on water quality in the area are identified and addressed in this EIAR chapter.

RECEIVING ENVIRONMENT

Study Area

7.27 The potential for the proposed development to effect the water environment is limited within the surface water catchment and groundwater bodies within which the site is located.

7.28 In terms of the hydrological environment (i.e. surface water), the water study area is limited within the catchment of the Delvin River.

7.29 In terms of the hydrogeological environment (i.e. groundwater), the site is underlain by the Lusk-Bog of the Ring and Duleek GWBs.

7.30 The water study area comprises the application site and the surrounding area up to 2km radius from the site boundary. This is in line with the Institute of Geologists of Ireland's (IGI) guidelines (2013).

Baseline Study Methodology

7.31 The methodology used in the investigation follows the guidelines and advice notes provided by the Environmental Protection Agency (EPA) on environmental impact assessments and with due regard to the Institute of Geologists of Ireland's (IGI) guidelines (2013).

7.32 A comprehensive geological, hydrological and hydrogeological dataset has been collected as part of this EIAR study.

Desk Study

7.33 A desk study of the site and the surrounding lands was completed in order to gather all relevant geological, hydrological, hydrogeological and meteorological data for the water study area. This desk study was updated and checked in September and October 2024. This desk study included consultation with the following sources of information:

- Environmental Protection Agency Databases (www.epa.ie);
- Geological Survey of Ireland – Groundwater Databases (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);

- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive Map Viewer (www.catchments.ie);
- Teagasc/GSI soil and subsoil mapping (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 13. Geological Survey of Ireland (GSI, 1999 and 2001);
- 3rd Cycle Boyne Catchment Report (EPA, 2024);
- Meath County Development Plan 2021 – 2027;
- Geological Survey of Ireland - Groundwater Body Characterisation Reports; and,
- OPW Flood Mapping (www.floodinfo.ie).

Site Investigations

7.34 In addition to the above desk study of publicly available data, 5 no. boreholes were drilled at the site in March 2019 to provide information on the sand and gravel deposits. These boreholes were used as monitoring wells to facilitate groundwater level monitoring at the site from January/February 2022 to May 2024.

7.35 Michael Gill (Hydrogeologist) of HES completed site walkover surveys at the site on 16th March 2023, 27th June 2024, and 16th July 2024.

EPA Licenced Activity

7.36 There are number of EPA licenced activities within 10km of the site:

- Clashford Recovery Facilities Ltd have applied for a waste licence in Naul, east of the site;
- Integrated Materials Solutions Ltd. Partnership have applied for permission for continued infilling of the former quarry with construction and demolition waste at the existing site at Hollywood Great, Nag's Head, Naul, c.5km south-east of the site;
- UWWT – Naul < 1km south-east, Stamullen c. 5km north-east, Garristown c. 6km west, Balbriggan c. 7km east, Portrane Donabate Rush Lusk c. 7km south-east, Ballyboghill c. 8km south, and Oldtown c. 8km; and,
- Within 10km of the site there are several section 4 discharges; licenced integrated pollution controls (IPC); licenced, applied and surrendered industrial emissions (IE); and licenced waste.

Topography, Physical Features, and Land-use

7.37 The site slopes gently upward in a northerly direction from c. 70mOD to c. 110mOD. The area to the north of the site continues to rise up to a maximum elevation of c. 155mOD. To the south, the land continues to fall towards the Delvin River before rising again to high point of c. 140mOD south of the R122 road and the Naul village. East and west of the site are at similar elevations to the site. Meanwhile, a small valley separates the proposed extraction areas from the R108 to the east.

7.38 The Delvin River flows along the southern boundary of the overall landholding and c. 50m from the application site. This river flows in an easterly direction towards the Irish Sea. The Fourknocks River flows c. 0.3km east of the site in a southerly direction initially and then flows to the east before it discharges into the Delvin River.

7.39 Land-use at the site comprises of agricultural land. The surrounding land is mainly agricultural farmland and dispersed residential housing. Naul town is less than 1km to the south-east of the site. There is a former sand and gravel pit directly to the southwest of the application area.

7.40 The site is located in the townland of Naul and can be accessed from the east via an existing agricultural track which extends westwards from the R108 regional road.

Rainfall and Climate

7.41 The nearest rainfall gauging station is at Garristown Garda Station, located c. 5.5km southwest of the site. The Average Annual Rainfall (AAR) at Garristown Garda Station is 846mm, for the 30-year period 1981-2010 (Met Eireann, 2020). The average monthly rainfall values for the 30-year period 1981-2010 can be seen in **Table 7-1** below.

Table 7-1
Average monthly rainfall total (mm) 1981-2010 Garristown Garda Station (Met Eireann, 2020)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
76.0	52.2	59.7	60.4	65.8	72.3	61.4	78.2	68.0	88.0	82.3	82.6

7.42 Met Eireann also provide a grid of the AAR for the entire country for the period of 1991 to 2020. Based on these more site-specific modelled rainfall values, the AAR in the immediate vicinity of the site ranges from 866 to 871mm/yr (with an average of 868mm/yr) (this is considered to be the most accurate estimate of AAR from the available sources).

7.43 The closest synoptic station where average potential evapotranspiration (PE) is recorded is at Dublin Airport, located c. 18km south-southeast of the site. The long-term average PE for this station is 560mm/yr. This value is used as a best estimate of the PE at the site. Actual Evapotranspiration (AE) is estimated as 532.1mm/yr (0.95 x PE).

7.44 The Effective Rainfall (ER) represents the water available for runoff and groundwater recharge and is calculated as:

Effective Rainfall (ER) = Annual Average Rainfall (AAR) – Actual Evapotranspiration (AE)

= 868mm/yr – 532mm/yr

= 336mm/yr

7.45 Based on groundwater recharge estimates from the Geological Survey of Ireland (GSI) map viewer (www.gsi.ie), groundwater recharge at the site ranges from 25% to 85%. The areas mapped as having lower groundwater recharge rates are situated towards the centre of the site with GSI stating that these areas contains low permeability subsoils. However, the majority of the site is mapped by the GSI as having high rates groundwater recharge due to bedrock being at or near the surface in the north of the site and due to the presence of permeable subsoils further south. An estimate of 80% groundwater recharge is taken as an average for the overall site due to the predominance of the permeable sand and gravel subsoils and the lack of any significant surface water drainage features within the site. Therefore, annual groundwater recharge and surface water runoff rates at the site are estimated to be 269mm/yr and 67mm/yr. Where vegetation and topsoil are removed for the proposed development and the bare subsoils are exposed, groundwater recharge will increase slightly (the increase will be relatively small given the existing high rates of groundwater recharge).

7.46 Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann (www.met.ie). The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation events of c.20%. In total the projected annual reduction in rainfall near the site is modelled as c. 8% under the medium-low emission scenario and c. 6% under the high emissions scenario. As stated above the local average long term rainfall data for the site is estimated to be 868mm/yr. Under the medium-low emissions scenario this may reduce to c. 799mm/yr, while under the high emissions scenario this figure may reduce to 816mm/yr.

Soils and Geology

7.47 Soils and geology are discussed in detail in Chapter 6 of this EIAR.

Soils and Subsoils

7.48 The GSI online mapping website (www.gsi.ie) publishes soil maps from Teagasc.

7.49 The Teagasc soils map for the local area shows that the site is underlain by predominantly acid shallow well drained mineral soils (AminSW) with some acid poorly drained mineral soils (AminPD) further south. Some basic shallow well drained mineral soils (BminSW) are also mapped towards the south of the site. Other mapped soils in the surrounding lands include alluvium along the Devlin River, immediately to the south of the overall landholding.

7.50 The GSI mapped subsoils at the site comprise of Irish Sea Till derived from Lower Palaeozoic sandstones and shales (IrSTLPSsS) in the east and west. Bedrock outcrop or subcrop (Rck) is mapped towards the centre of the site. Meanwhile, gravels derived from Lower Palaeozoic sandstones and shales (GLs) are mapped towards the south. Other subsoils in the surrounding lands include alluvium (A) along the Delvin River along the southern boundary of the landholding. Some lacustrine sediments are also mapped c. 170m to the east of the site.

7.51 Maps of local soil and subsoils are shown as **Figure 6-1** and **Figure 6-2** in Chapter 6

7.52 Five boreholes were drilled at the site in 2019 (refer to Chapter 6). The site investigations revealed the nature of the subsoils and the thickness of the granular deposits. The subsoils were noted to comprise of glacial till material as well as sand and gravel. The thickness of the sand and gravel varies across the site from 2.8m at BH1 in the southeast to 19.75m in BH2 towards the centre of the site.

7.53 Additional trial pits were completed along the proposed access track in October 2024. Trial pit logs and a trial pit location map are attached in **Appendix I**. Infiltration tests were also completed in each of the trial pits and the results of those tests are included on each of the trial pit logs.

Local Bedrock Geology

7.54 The GSI's 1:100,000 bedrock geological mapping shows the northern section of the site is underlain by the Ordovician Clashford House Formation, comprising micaceous green to brown-grey mudstones and siltstones with andesite sheets occurring throughout. Meanwhile, the south and southeast of the site are underlain by the Naul Formation, comprising calcarenite with minor chert and occasional thin shales from the Carboniferous Period. A bedrock geology map is included as **Figure 6-3** in Chapter 6.

7.55 The Clashford House and Naul Formations are separated by a mapped fault. There are several additional faults and folds mapped in the surrounding area, and also several different bedrock geological formations.

7.56 Bedrock at the site is buried beneath a significant thickness of soil and subsoils with limited bedrock exposures in the local area. The 5 no. boreholes completed at the site ranged in depth from 11.5 to 30m and did not encounter any bedrock (contrary to the GSI mapped subsoils which indicated that there was some bedrock outcrop/subcrop within the site).

Surface Water – Hydrology

Regional and Local Hydrology

7.57 The site is located within the Nanny-Delvin surface water catchment within Hydrometric Area 8 of the Eastern River Basin District. This catchment includes the area drained by the Rivers Nanny and Delvin and by all streams entering tidal water between Mornington Point and Sea Mount, Co. Dublin, draining a total area of 711km². The Nanny River flows east from Kentstown, after which it is joined from the south by the River Hurley, which drains the area north of Ashbourne. The Nanny continues east through Duleek before flowing into the Irish Sea at Laytown. The Delvin River flows north east from Garristown and through Stamullin before entering the sea at Knocknagin Viaduct. A regional hydrology map is shown as **Figure 7-1**.

7.58 More locally, the site is located in the Delvin River sub-catchment (Delvin_SC_010) and the Delvin_020 WFD river sub-basin. There are no EPA mapped hydrological features within the site. The Delvin River flows to the east along the southern boundary of the overall landholding and c. 50m south of the site. Downstream of the site the Delvin river flows through the Naul village. Meanwhile, the EPA named Fourknocks River flows to the south c. 0.3km east of the site before veering to the east. The Fourknocks River discharges into the Delvin River c. 1.1km east of the site. Downstream of this confluence, the Delvin River flows through Stamullin. A local hydrology map showing the location of the Delvin and Fourknocks River to the site is shown in **Figure 7-2**.

7.59 The rivers in the vicinity and downstream of the site are not designated shellfish or salmonid waters nor is the Delvin River identified as a nutrient sensitive area.

7.60 The Irish Sea is c. 8.5km east and downstream of the site. This coastal area is a designated shellfish area. These coastal waters also intersects with SAC species and habitats, and SPA habitats (refer to para. 7.132. The length of the hydrological flowpath between the site and the Irish Sea is c. 11.6km (note, that this is not a direct hydrological flowpath as the majority of water falling on the site percolates to ground and only discharges as baseflow into the Delvin River via groundwater flow).

Existing Site Drainage

7.61 There are 2 no. open drainage ditches within the site, along existing field boundaries and hedgerows which direct surface water runoff to the Delvin River. The main drainage ditch is located along the existing hedgerow boundary to the west of Phase 1 where it turns 90 degrees to the east before turning 90 degrees south and runs along the field boundary between Phases 2 and 3, and discharges into the Delvin River. A smaller northeast to southwest orientated drainage ditch is located between Phases 1 and 2, and discharges into the main drainage ditch before it veers to the south. These drainage ditches are typically dry and only respond to high rainfall events. The vast majority of rainfall falling at the site recharges to ground.

Surface Water Flows

7.62 There is an active OPW hydrometric gauge on the Delvin River near Naul Bridge less than 1km to the east and downstream of the site. The gauging station at Naul has been operational at its current location since 2009 and is located upstream of the Naul wastewater treatment plant. The upstream catchment area for the Delvin River at this station is 33.4km^2. Based on the recorded flow data the Delvin River at this location has a 50%ile flow of 0.281m^3/s and a 95%ile flow of 0.06m^3/s. Note that a 95%ile flow equates to the flow which is equalled or exceeded 95% of the time. A flow duration curve for the recorded flows at this gauging station is presented in **Diagram 7-1** below.

7.63 There are no other OPW gauging stations located downstream of the site. Therefore, the EPA's hydrotool, available on www.catchments.ie, was consulted in order to estimate the baseline flow volumes in the local area and further downstream of the site. The Hydrotool dataset contains estimated of naturalise river flow duration percentiles. Several nodes were consulted. **Diagram 7-2** below presents a flow duration curve for several Hydrotool Nodes downstream of the site as follows:

- Node 08_314 on the Delvin River upstream of its confluence with the Fourknocks River;
- Node 08_238 on the Delvin River upstream of its confluence with the Stadalt River;
- Node 08_714 on the Delvin River in Stamullen; and,
- Node 08_138 on the Delvin River upstream of where it discharges into the Irish Sea.

7.64 Due to increasing catchment sized, the estimated flow volumes at the nodes along the Delvin River downstream of the site increase progressively downstream. For example, at Node 08_314 upstream of the confluence with the Fourknocks River, the 95%ile flow in the Delvin River is estimated to be 0.063m^3/s. Meanwhile upstream of its discharge point into the Irish Seam the 95%ile flow at Node 08_137 is estimated to be 0.145m^3/s.

Diagram 7-1

Flow Duration Curve for the Delvin River at the Naul (Delvin) Gauging Station

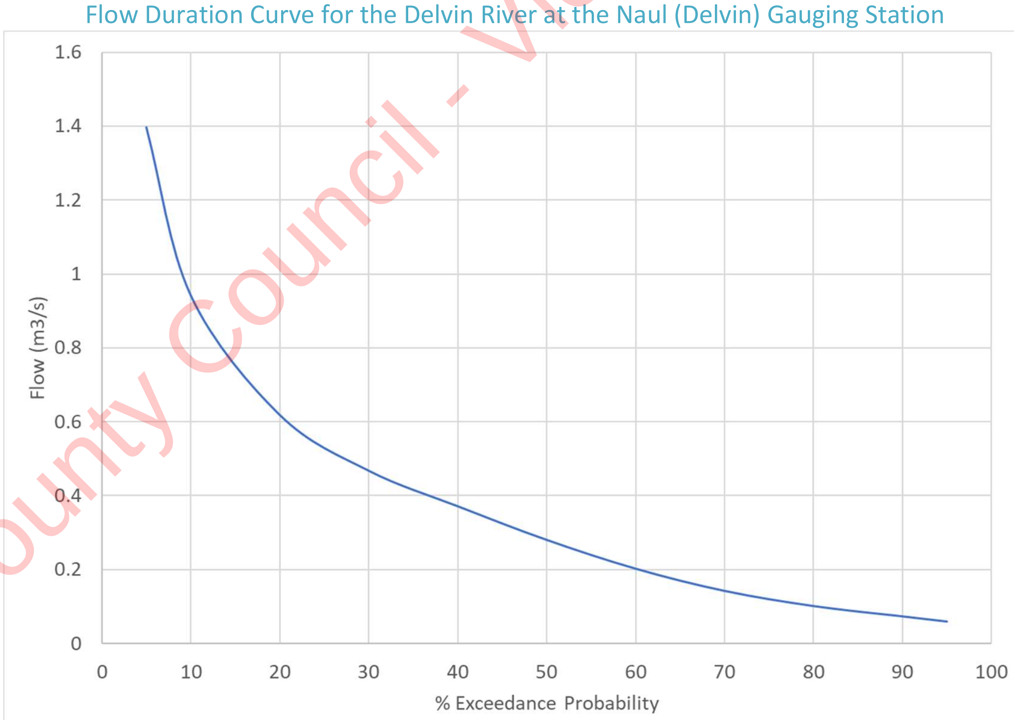
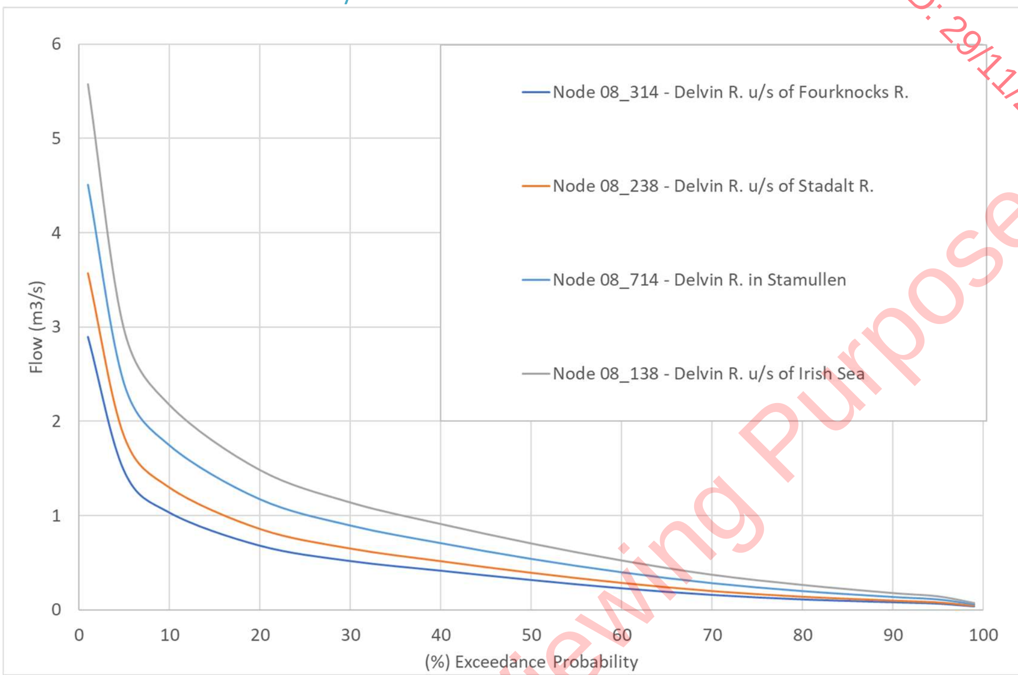


Diagram 7-2
EPA HydroTool Node Flow Duration Curves



Surface Water Quality

7.65 Biological Q-rating data for EPA monitoring stations are available on the Delvin River downstream of the site and are presented in

7.66 **Table** 7-2. The Q-rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from Q1 (Bad) to Q4-5 (High). No Q-rating data is available for the Fourknocks River to the northeast of the site.

7.67 The Q-rating data from 2020 is available for the Delvin River immediately upstream and downstream of the site. Upstream of the site, at a bridge northwest of Naul (Station Code: RS08D010080), the Naul River achieved a Q3 rating ('Poor' status). Meanwhile, downstream of the site at a bridge northwest of Forty Acres (Station Code: RS08D010250) the Delvin River achieved a Q-rating of Q3-4 ('Moderate' status). Further downstream at a bridge north of Bridgefoot House (Station Code: RS08D010400) the Delvin River achieved a Q3 rating.

7.68 The locations of the EPA monitoring stations are shown on **Figure 7-2**.

7.69 4 rounds of baseline surface water quality sampling were also completed at SW1 (upstream) and SW2 (downstream) (refer to **Figure 7-2**). Original laboratory reports are attached in **Appendix G**.

7.70 The laboratory results of the surface water sampling are comparable to the Q-rating data, and indicates a water quality being reduced slightly by catchment pressures including agriculture and wastewater discharges. Suspended sediment data is low in all monitoring.

Table 7-2
Latest EPA Water Quality Monitoring Q-Values (2020)

Watercourse	Station ID	Easting	Northing	Q-Rating
Delvin River	RS08D010080	311989	260675	Q3
Delvin River	RS08D010250	314364	263782	Q3-4
Delvin River	RS08D010400	317089	265756	Q3

Water Framework Directive

7.71 Local Surface Water Body (SWB) Water Framework Directive (WFD) information is available for review at www.catchments.ie and further details are provided in the 3rd Cycle Nanny-Delvin Catchment Report (EPA, 2024). Summary WFD information for the SWBs draining the site is presented in **Table 7-3** below.

7.72 The Delvin_020 SWB in the vicinity and downstream of the site achieved 'Moderate' status in all 3 no. WFD cycles. Further downstream the Delvin_030 SWB achieved 'Moderate' status in the latest WFD cycle (2016-2021), an improvement on the 'Poor' status which it was assigned in the 2013-2018 cycle. Meanwhile, the Delvin_040 SWB was assigned 'Poor' status in all 3 no. WFD cycles.

7.73 In terms of risk status, all 3 no. river waterbodies downstream of the site are deemed to be 'at risk' of failing to meet their respective WFD objectives.

7.74 The 3rd Cycle Nanny-Delvin Catchment Report (EPA, 2024) states that agriculture is the most significant pressures impacting waterbodies in this catchment. In the vicinity and downstream of the site agriculture is listed as a significant pressures on the Delvin_020, _030 and _040 SWBs. Extractive industry and hydromorphological issues are also listed as significant pressures on the Delvin_020 SWB. Further downstream domestic wastewater and urban wastewater are listed as additional significant pressures on the Delvin_030 and Delvin_040 SWBs respectively.

Table 7-3
Summary WFD Information for Surface Waterbodies

SWB	Status (2010-2015)	Status (2013-2018)	Status (2016-2021)	Risk Status	Pressures
Delvin_020	Moderate	Moderate	Moderate	At risk	Agriculture, extractive industry and hydromorphology
Delvin_030	Unassigned	Poor	Moderate	At risk	Agriculture, industry and domestic wastewater
Delvin_040	Poor	Poor	Poor	At risk	Agriculture and urban wastewater

Surface Water Abstractions

7.75 The Delvin and Fourknocks rivers in the vicinity and downstream of the site are not designated as drinking water protected areas (www.catchments.ie). There are no surface water abstractions for drinking water located downstream of the site.

Flooding

7.76 To identify those areas as being at risk of flooding, the OPW's Past Flood Events Maps, the National Indicative Fluvial Mapping, CFRAM River Flood Extents, historical mapping (i.e. 6" and 25" base maps) and the GSI Groundwater Flood Maps were consulted. These flood maps are available to view at www.floodinfo.ie. A Flood Risk Assessment is attached as **Appendix H**.

7.77 Identifiable text on local available historical 6" or 25" mapping does not identify any lands which are liable to flood in the vicinity of the site.

7.78 Benefiting lands is a dataset prepared by the OPW identifying land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage. There are no benefiting lands in the vicinity or downstream of the site.

7.79 Meanwhile, the Delvin River to the southwest and upstream of the site forms part of the Garristown and Delvin Drainage District. Drainage Districts were carried out by the Commissioners of Public Works under a number of drainage and navigation acts from 1842 to the 1930s to improve land for agriculture and to mitigate flooding. Channels and lakes were deepened and widened, weirs removed, embankments constructed, bridges replaced or modified and various other work was carried out. The purpose of the schemes was to improve land for agriculture, by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows.

7.80 The OPW Past Flood Events Maps have no records of recurring or historic flood instances within the site. The closest mapped historic flood event (Flood ID: 1698) is located to the east and downstream of the site along the Delvin River in Naul village and dates from December 1978. A recurring flood event is also recorded further downstream along the Delvin River in Stamullin (Flood ID: 942).

7.81 The GSI Winter 2015/2016 Surface Water Flood Map shows surface water flood extents for this winter flood event. This flood event is recognised as being the largest flood event on record in many areas. This flood map does not show any historic flood zones within the site or downstream of the site.

7.82 CFRAM mapping has been completed along the Delvin River to the south of the site. However, in the vicinity of the site the medium (1 in 100-year) and low probability (1 in 1,000-year) fluvial flood zones do not extend any distance away from the river channel. No CFRAM fluvial flood zones encroach upon the site. CFRAM flood zones are mapped along the Delvin River immediately to the south of the overall landholding and c. 50m south of the site.

7.83 The National Indicative Flood Map (NIFM) for the Present Day Scenario does not record any fluvial flood zones within the site. The closest mapped NIFM fluvial flood zones are located c. 2.9km to the north of the site.

7.84 Based on site walkover surveys, the permeable nature of the local subsoils and the sloping topography, there is deemed to be little risk of pluvial flooding.

7.85 Furthermore, there are no historic or modelled groundwater flood zones in the site or in the surrounding lands.

7.86 Based on the above, the site is considered to be at low risk of flooding.

Groundwater – Hydrogeology

Regional Hydrogeology

7.87 The GSI mapped soil and subsoils deposits vary throughout the site. Subsoils in the northwest are mapped by the GSI as sandstone and shale till, the northeast is mainly bedrock at the surface, and the south is glaciofluvial sands and gravels, all derived from non-calcareous parent materials. Intrusive site investigations comprising of boreholes have revealed thick deposits of till and sand and gravels at the site. The sand and gravel at the site is not classified by the GSI as an aquifer. The closest sand and gravel aquifer recorded on the GSI online database (www.gsi.ie) is the Laytown-Gormanstown Locally Important Gravel Aquifer, situated c. 5.7km northeast of the site.

7.88 According to GSI bedrock mapping (www.gsi.ie) the northern area of the site is underlain by Ordovician mudstones and siltstones with andesite sheets occurring throughout from the Clashford House Formation. The GSI classify the bedrock underlying the northern area of the site as a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones. Meanwhile, the southern area of the site is underlain by the Carboniferous calcarenite with minor chert and occasional thin shales from the Naul Formation. The GSI classify the Naul Formation as a Locally Important Aquifer – Bedrock which is Generally Moderately Productive (refer to **Figure 7-3**).

Groundwater Bodies

7.89 The northern section of the site is underlain by the Duleek Groundwater Body (GWB) while the southern area is underlain by the Lusk-Bog of the Ring GWB (Lusk GWB). A map of GWBs is included as **Figure 7-4**.

7.90 Initial characterisations of the GWBs have been developed by the GSI, and augmented by the River Basin District (RBD) consultants and are presented in **Appendix 7-B**. A summary of the GWB descriptions is included below.

Duleek GWB

7.91 The Duleek GWB covers an area of 114km^2 and is comprised of poorly productive bedrock - bedrock which is generally unproductive except for local zones.

7.92 The majority of the groundwater flow will take place through the upper 3m of the aquifer in the broken, weathered and fractured rock zone. Major groundwater flows are not expected to be encountered below 10m of the surface of the surface. Flowpaths are not considered to extend further than the nearest surface water feature and will generally not be greater than 500m. As it is a poor aquifer, transmissivity is presumed to be generally low (<10m^2/d). However, deep water strikes in more isolated faults/ fractures can be encountered at 30-50mbgl.

7.93 Diffuse recharge will occur via rainfall percolating through the subsoil. The proportion of the effective rainfall that recharges the aquifer is largely determined by the thickness and permeability of the soil and subsoil, and by the local topographic slope. Due to the generally low permeability of the aquifers within this GWB, a high proportion of the recharge will discharge rapidly to surface watercourses via the upper layers of the aquifer, effectively reducing further the available groundwater resource in the aquifer.

7.94 This aquifer will discharge to the overlying rivers and streams in the area as baseflow. The low permeability rocks in the area will not sustain large summer baseflows and it is more likely that the majority of the groundwater flow will discharge to the rivers after a short lag time in the weathered zone of the aquifer.

7.95 There is little hydrochemical analysis available for this GWB as there are no EPA monitoring sites located within it.

Lusk Bog of the Ring

7.96 The Lusk GWB covers an area of 209km^2 and consists of productive fissured rock that is classified as a locally important aquifer - bedrock which is generally moderately productive.

7.97 The hydrogeology is strongly related to the structural deformation associated with the faulting in the Bog of the Ring area. Therefore, the nature of the groundwater flow will be determined by the degree of karstification and fracturing and the purity of the limestones. Where it is highly karstified, flow will be concentrated into conduits which may draw water very deep underground. Where it is not karstified flow systems will be shallower and more diffuse. Drilling has shown significant inflow from limestone fissure depths of 30m, 70m, and 90m.

7.98 Flowpath lengths are variable, some flowpaths of up to a couple of kilometres exist, although distances of a few hundred metres are more likely.

7.99 Transmissivity values along the northern boundary of the GWB are estimated to be very high, in the region of 580m^2/d. Higher permeability zones have developed close to the surface and permeabilities decrease with increasing depth below ground level.

7.100 There are two mechanisms for recharge in this GWB; point recharge and diffuse recharge. Due to the karstic nature of the aquifer it is possible to have point recharge, diffuse recharge occurs over the area and will be higher in the north of the GWB (near the site) where subsoil is thinner and/ or more permeable.

7.101 Groundwater can discharge from this aquifer as baseflow to streams, as springs and as abstractions via wells for human consumption. The north of the GWB is one of the main discharge points. Groundwater will discharge at the geological contact between the limestones and the less permeable Ordovician rocks to the north.

7.102 The hydrochemical analyses of groundwater indicate very hard water (355-435mg/l $CaCO_3$) with high alkalinity (310-325mg/l $CaCO_3$), conductivity ranges from 520-810µS/cm. The groundwater can be classed as calcium-bicarbonate water.

Groundwater Vulnerability

7.103 Groundwater Vulnerability is a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities (www.gsi.ie). More scientifically, groundwater vulnerability embodies the characteristics of the intrinsic geological and hydrogeological features at a site that determine the ease of contamination of groundwater.

7.104 According to the GSI online groundwater vulnerability map (www.gsi.ie) the groundwater vulnerability of the site ranges from High (H) to X (rock at or near the surface or karst) (**Figure 7-5**). Much of the centre of the site has areas mapped as X vulnerability with this area surrounded by areas of Extreme (E) vulnerability. The areas mapped as having high vulnerability are limited to the western and eastern margins of the site. In accordance with **Table 7-4** below this mapping indicates subsoil thicknesses of less than 10m.

7.105 However, the 5 no. boreholes completed at the site ranged in depth from 11.5 to 30m and did not encounter any bedrock. Therefore, based on this site-specific data, the groundwater vulnerability at the site is likely to be High – bedrock is located at depth but it overlain by relatively permeable subsoil deposits.

7.106 During the proposed development the topsoil and some of the subsoil/ gravel overburden will be removed from the proposed extraction areas. This will increase the groundwater vulnerability rating within the proposed extraction areas.

Table 7-4
Vulnerability Rating

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	> 3.0m	3.0 - 10.0m	3.0 - 5.0m	> 3.0m	N/A
Moderate (M)	N/A	> 10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	> 10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

Groundwater Recharge

7.107 The GSI's Characterisation Report for the Lusk-Bog of the Ring GWB (GSI, 2004) states that in this GWB diffuse recharge occurs over the majority of the area, and it is higher in areas where subsoil is thinner or permeable. Due to the karstic nature of the aquifer it is also possible to have point recharge.

7.108 The GSI's Characterisation Report for the Duleek GWB (GSI, 2004) states that due to the general low permeability nature of the bedrock, recharge will discharge rapidly to nearby surface waters.

7.109 Intrusive site investigations have revealed a substantial thickness of permeable sand and gravel deposits at the site. These granular subsoils will not restrict groundwater recharge. As a result the majority of rainfall currently falling at the site recharges to ground. The existing drainage ditches only convey surface water runoff during high intensity rainfall events.

7.110 A map of the GSI groundwater recharge estimates for the site is shown as **Figure 7-6**.

Water Framework Directive

7.111 Local GWB Water Framework Directive (WFD) information is available for review at www.catchments.ie and further details are provided in the 3rd Cycle Nanny-Delvin Catchment Report (EPA, 2024). Summary WFD information for the GWBs underlying the site is presented in **Table** 7-5 below.

7.112 The Duleek and Lusk – Bog of the Ring GWBs underlying the site have been assigned 'Good' status in all 3 no. WFD cycles. The Duleek GWB has been deemed to be 'not at risk' of failing to meet its

WFD objectives. No significant pressures have been identified to be impacting this GWB. Meanwhile, the Lusk – Bog of the Ring GWB has been deemed to be 'at risk' of failing to meet its WFD objectives and is under significant pressure from domestic wastewater.

Table 7-5
Summary WFD Information for Ground Waterbodies

SWB	Status (2010-2015)	Status (2013-2018)	Status (2016-2021)	Risk Status	Pressures
Duleek	Good	Good	Good	Not at risk	None
Lusk Bog of the Ring	Good	Good	Good	At risk	Domestic Wastewater

Karst Features

7.113 Karst features are mapped by the GSI and are available to view through the GSI online viewer (http://www.gsi.ie/www.gsi.ie).

7.114 There are no GSI mapped karst features within the site. The closest GSI mapped karst feature is a cave (GSI ID: 2925NEK001) in Naul town, located c. 150m south of the southeastern corner of the overall landholding boundary. The cave is development in the Naul Formation according to the GSI mapping. There are no other mapped karst features within 5km of the site.

7.115 No karst features were recorded during the site walkover surveys.

Groundwater Abstraction & Wells

7.116 This GSI do not map the presence of any National Federation registered Group Water Schemes (GWS) or Public Water Schemes (PWS) or an associated source protection area within the site.

7.117 The closest mapped PWS is the Bog of the Ring PWS. The outer source protection area associated with this supply is located c. 1km to the southeast of the site, refer to **Figure 7-7**. According to the Groundwater Source Protection Zone Report for the Bog of the Ring PWS (GSI, 2005);

- 4 no. boreholes are used for this PWS.
- Currently they supply a combined volume of around 3,500m^3/d.
- The boreholes at the Bog of the Ring PWS are excellent yielding wells, which are located in a fractured zone in a locally important aquifer which is moderately productive. The high yields are due to the presence of a high transmissivity zone supported by a significant gravel horizon.
- The long-term yield is limited by the low recharge and presence of relatively poor bedrock aquifers bounding the main 'Bog of the Ring aquifer'. The high transmissivity zones act as horizontal pathways, and maintenance of well yields is largely dependent on water feeding into them from surrounding aquifers.

7.118 The GSI national groundwater well database does not record the presence of any groundwater wells within the site. It does record the presence of over 30 no. groundwater wells within a 5km radius of the site. The majority of the boreholes mapped in the Duleek GWB have poor yields, whereas the majority in the Lusk GWB have excellent yields. The boreholes are typically used for domestic and agricultural purposes, but several are also used for public water supplies.

7.119 It is understood that there is no mains water supply or GWS in the area of the site. Dwellings in the local area have individual private groundwater well supplies.

7.120 A detailed well survey of residences within a 500m radius of the site was also completed in response to the RFI issued for the previous planning application in 2019. The wells identified during this survey are shown on **Figure 7-8**. The results of the well survey are as follows:

- Several dwellings were located to the east and west of the site at distances in excess of 200m from the site. These wells are located lateral to the site (i.e. not down-gradient);
- 3 no. wells (R2, R3 and R4) are located down-gradient of the site (to the southeast) and on the northern side of the Delvin River. These wells are located closer to the proposed internal access track and are remote from the proposed extraction areas (c. 400m separation distance);
- Several swellings are located to the south of the Delvin River.

7.121 Whilst the Inspector's Report for the previous application (AA191263) acknowledges that the results of this survey were presented in the RFI response, it states that "not all wells in the vicinity of the site were surveyed". The assessment presented in the impact assessment of this EIAR chapter assumes a worst-case scenario whereby all local dwellings have a groundwater well supply.

On-site Monitoring Wells

7.122 5 no. on-site groundwater monitoring boreholes were installed at the site in 2019, details can be seen in **Table 7-6** below. The 5 no. monitoring wells consist of shallow boreholes with installations in the subsoils/ gravel deposits. The monitoring boreholes were not extended to the underlying bedrock. The borehole logs are presented in Chapter 6. The location of the monitoring wells are shown in **Figure 7-9**.

Table 7-6
Borehole details

Borehole	Elevation Top of Casing (mOD)	Easting	Northing
BH1	78.12	712429.707	761160.467
BH2	92.69	712278.531	761294.543
BH3	102.46	712009.904	761402.111
BH4	80.24	712128.581	760996.501
BH5	86.16	712233.479	761162.646

Groundwater Levels

7.123 Continuous groundwater level monitoring has been completed at 4 no. on-site boreholes (BH1, BH2, BH3 and BH4) from the January/February 2022 to May 2024. 2 no. dataloggers were installed in BH1 and BH4 on 11th January 2022 with an additional 2 no. dataloggers installed in BH3 and BH4 on the 10th February 2022. The installation of these dataloggers allowed for the continuous monitoring (15-minute intervals) of the groundwater levels at the site. These data sets are comprehensive and overcome one of the issues raised by the Board on the previous application (i.e. the apparent lack of water level data to underpin the hydrogeological understanding of the site).

7.124 The groundwater levels recorded during this 29-month monitoring period are presented in **Diagram 7-3** alongside rainfall data from Bellewstown rainfall station. The maximum and minimum water levels are detailed in **Table 7-7.** The greatest water levels were recorded in BH3 in the north of the site. The elevation of the groundwater table falls to the south/southeast towards the Delvin River. The recorded range in water levels is <2m in BH1, BH2 and BH4. A greater range in water levels of c. 6m was recorded in BH3 in the north of the site. The maximum recorded water levels occurred during the spring of 2024 (note that the winter of 2023/2024 was one of the wettest on record).

7.125 As noted previously, no active dewatering (i.e. pumping of groundwater) is proposed as part of the proposed development. It is expected that the deposits will drain through gravity to the south.

Diagram 7-3
Naul groundwater levels (mAOD)

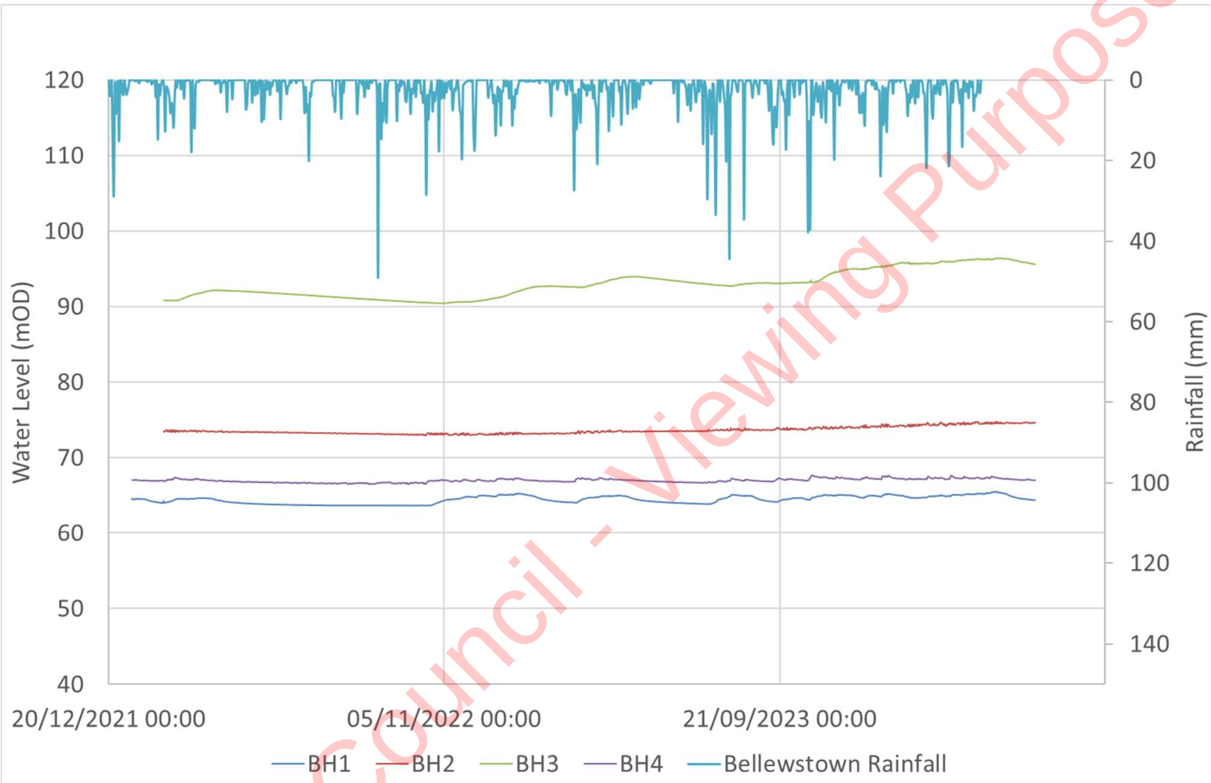


Table 7-7
Maximum and minimum groundwater levels (mAOD)

	BH1	BH2	BH3	BH4
Maximum groundwater level (mAOD)	65.53	74.81	96.46	67.68
Minimum groundwater level (mAOD)	63.66	72.95	90.45	66.52
Range (m)	1.87	1.86	6.01	1.16

Meteorological Conditions During Water Level Monitoring Period

7.126 This section presents a brief discussion of the meteorological conditions during the groundwater level monitoring period.

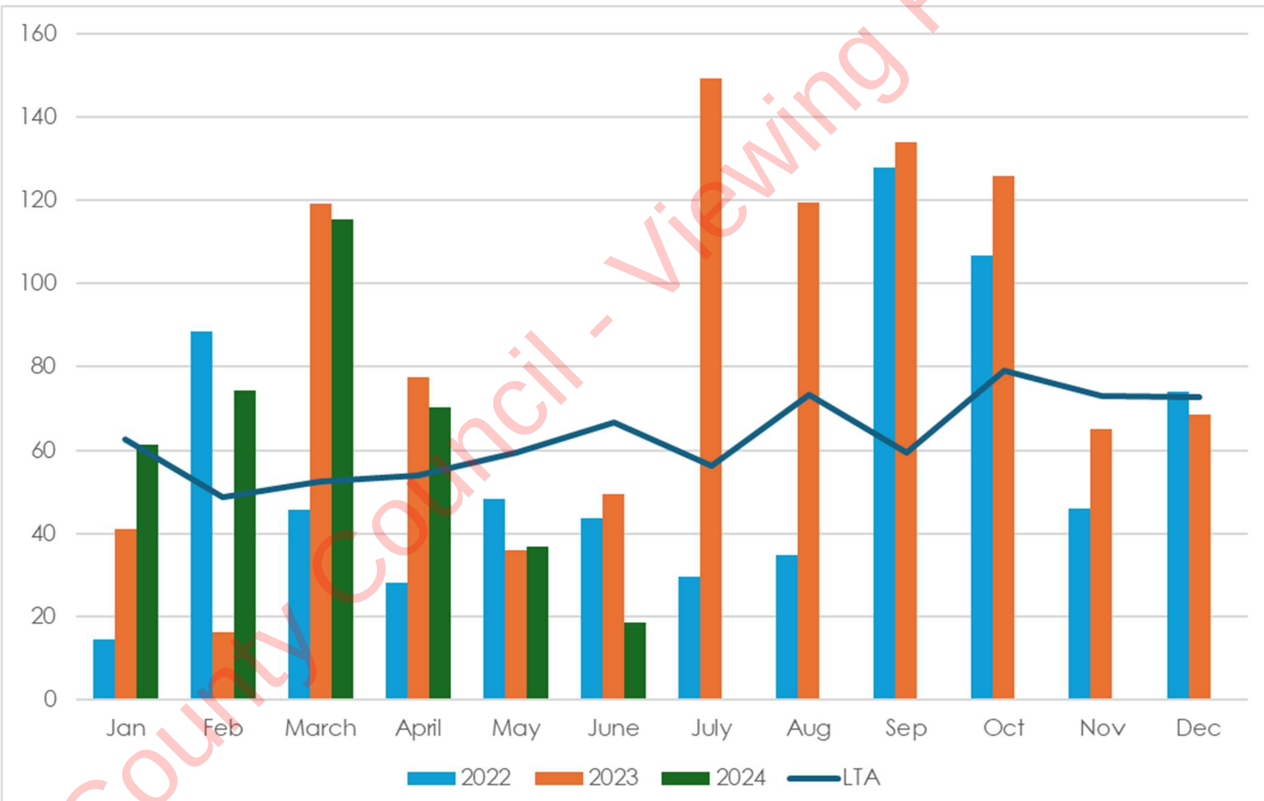
7.127 **Diagram 7-4** below presents the monthly rainfall totals for January 2022 to June 2024 recorded at Dublin Airport situated c. 18k to the south of the site. These monthly precipitation totals are compared to the Long-Term Average (LTA) at Dublin Airport (www.met.ie/climate/available-date/monthly-data). As seen from the diagram, the monitoring period has coincided with some of the wettest periods in recent years. In particular the autumn of 2022, the late summer and autumn 2023 and the spring of 2024 were particularly wet periods.

7.128 Therefore, the water levels recorded during this monitoring period represent some extreme water levels. The highest water levels were recorded in the spring of 2024 and these elevated levels resulted from the very high levels of rainfall in the late summer and autumn of 2023 and the spring of 2024.

7.129 It is considered that the length of the groundwater monitoring period is sufficient due to the meteorological conditions which resulted in maximum groundwater levels and the small range in groundwater levels recorded at most of the monitoring locations.

Diagram 7-4

Monthly and Long-Term Average Rainfall Values for Dublin Airport (www.met.ie)



Protected Areas

7.130 Within the Republic of Ireland, designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

7.131 The NPWS map viewer (www.npws.ie) indicates that while there are no protected areas within the site, there are a number of protected areas within 10km of the site. The potential for hydrological or hydrogeological connection between the site and these protected areas is outlined below in **Table 7-8**.

7.132 An indirect hydrological connections exist between the site and the North-West Irish SPA via groundwater recharge and flow at the site and the Delvin River. The total length of the hydrological flowpath between the site and this SPA is c. 11.8km. Despite the indirect connection between the site and the SPA, there is limited potential for effects given the length of the hydrological flowpath and the large volume of water with the coastal waterbody within which the SPA is located (i.e. Northwestern Irish Sea SWB).

7.133 There are no other direct/indirect hydrological connections between the site and other designated sites or protected areas. All other designated sites lack a hydrological connection to the site, are distant from the site and local rivers and streams act as hydrological barriers between the site and these protected areas. A map of local designated sites is shown as **Figure 7-10.**

Table 7-8
Protected area assessment

Protected area	Location in relation to application site	Comment
Bog of the Ring pNHA (001204)	3.5km east	Located in the Lusk GWB and the same aquifer. Not groundwater fed. No surface water connection between the site and this pNHA – Delvin River acts as a hydrological barrier.
Cromwell's Bush Fen pNHA (001576)	3.5km north-west	Located in the Duleek GWB but in a different aquifer. No surface water connection between the site and this pNHA – Stadalt River acts as a hydrological barrier.
Knock Lake pNHA (001203)	5.9km east	Located in a separate GWB and aquifer. No surface water connection between the site and this pNHA – Delvin River acts as a hydrological barrier.
River Nanny Estuary and Shore SPA (004158)/ Laytown Dunes Nanny Estuary pNHA (000554)	8.2km north-east	Southern area of the SPA/ pNHA is in the same GWB as the site (Duleek GWB), but in a different aquifer. No surface water connection between the site and this pNHA – Delvin and Stadalt rivers act as hydrological barriers.
North-West Irish Sea SPA (004236)	7.2km northeast	This SPA is hydrologically connected with the site via the Delvin River which discharges into the SPA. The total length of the hydrological pathway between the site and the SPA is 11.8km.

Sensitive Receptors

7.134 This section discusses the sensitivity of the receiving hydrological and hydrogeological environment in terms of the proposed development and identifies those receptors which will be carried forward into the impact assessment.

7.135 In terms of groundwater, the following receptors are identified for impact assessment:

- The Locally Important Bedrock Aquifer underlying the south of the site.
- The Poor Bedrock Aquifer underlying the majority of the site.
- Local private groundwater abstractions; and,
- The WFD status of the GWBs underlying the site (Duleek and Lusk – Bog of the Ring GWBs).

7.136 In relation to surface waters, the only primary pathway between the site and nearby surface waters is via groundwater recharge, groundwater flow and baseflow into the Delvin River. Only very small volumes of surface water runoff currently exist at the site. The quantification of flow volumes in the vicinity and downstream of the site presented in Diagram 7-2 shows that the watercourses in the immediate vicinity of the site will be most susceptible to potential effects. Further downstream, the watercourses will be less susceptible to potential effects due to increasing flow volumes (as the contributing catchments increase in size). The following surface water receptors are identified for impact assessment:

- The local surface watercourses in the vicinity and downstream of the site (i.e. the Delvin River); and,
- The WFD status of the SWBs in the vicinity and downstream of the site.

7.137 In terms of designated sites, only those designated sites which is hydrologically/hydrogeologically connected with the proposed development is the North-West Irish Sea SPA. However, this SPA has not been included in the impact assessment due to the large volumes of water within this coastal waterbody, the saline nature of these waters and the length of the hydrological flowpath between the site and the SPA. There is no potential for the proposed development to impact on water quality or water quantity of this designated site. There is no connection between the site and any other designated site or protected area.

7.138 For each identified receptor the significance and sensitivity of the receptor is assessed and a rating (High/ Medium/ Low/ Negligible) is applied, see **Table 7-9** below, based on the rating of existing environment guidance Significance / Sensitivity set out in **Appendix 7-C**.

Table 7-9
Existing Environment – Significance and Sensitivity

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance/ Sensitivity Rating (H/M/L/N)
1	Locally important aquifer beneath the site.	Part of Lusk GWB. The GWB is of Good status. Abstracted for drinking water.	The status of the GWB is “at risk” of failing to meet its WFD objectives.	Medium - Attribute has a medium quality or value on a local scale.
2	Poorly productive aquifer beneath the site.	Part of Duleek GWB. The GWB is of Good status. Abstracted for drinking water.	This GWB is “not at risk”.	Low - Attribute has a low quality or value on a local scale.

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance/ Sensitivity Rating (H/M/L/N)
3	Domestic groundwater well supplies.	Private supply wells in vicinity of site.	Groundwater supply wells are sensitive to changes in the aquifer (groundwater quality/quantity).	Medium – Attribute has a medium quality or value on a local scale.
4	Bog of the Ring PWS	Public supply well c. 1km from site.	The groundwater in the bedrock aquifer is used for water supplies. Reduction in groundwater volumes and quality.	High – Attribute has a high quality or value on a local scale.
5	Delvin River.	The Delvin River is located in the vicinity and downstream of the site. This SWB is of Moderate status.	Reduction in surface water quality. Alteration of surface water flow volumes.	Medium – Attribute has a medium quality or value on a local scale.

Site Baseline Summary

7.139 The site is located on the lower part of a gently sloping valley trending east-west. Land-use at the site comprises of agricultural farmland. The surrounding land is mainly agricultural farmland and dispersed residential housing. Naul Town is less than 1km to the southeast.

7.140 The Average Annual Rainfall at the site is 868mm from 1991-2020 (www.met.ie). Effective rainfall is 336mm/yr.

7.141 The site investigations at the site encountered thick deposits of sand and gravels as well as glacial till subsoils.

7.142 The bedrock in the north of the site is mapped by the GSI to comprise of mudstones and siltstones from the Clashford House Formation. Bedrock in the south is mapped as calcarenite from the Naul Formation. Site investigations reveal that the depth to rock exceeds 11-30m at the site. No bedrock was encountered during the site investigations.

7.143 The Delvin River flows along the southern boundary of the overall landholding and c. 50m south of the site. The river flows in an easterly direction towards the Irish Sea. The Fourknocks River flows c. 0.3km east of the site in a southerly direction initially then in an easterly direction before discharging into the Delvin River. The Irish Sea is c. 8.5km east of the site (straight line distance). Neither river is shellfish, salmonid or nutrient sensitive, nor do they intersect a SAC or SPA.

7.144 The Delvin and Fourknocks rivers form part of the Delvin_020 SWB which achieved 'Moderate' status in the latest WFD cycle (2016-2021). This SWB has been deemed to be 'at risk' of failing to meet its WFD objectives and is under pressures from agricultural activities, extractive industry and hydromorphological issues.

7.145 All relevant flood mapping was consulted and indicates that the site is at low risk of flooding. Some CFRAM fluvial flood zones are mapped along the Delvin River to the south of the site, however in the vicinity of the site the mapped flood zones do not extend any significant distance from the river channel. No flood zones encroach upon the site.

7.146 The mudstone and siltstone bedrock in the north of the site is classified as a Poor Aquifer (Pl) and forms part of the Duleek GWB. This GWB achieved 'Good' WFD status (2016-2021 and is 'not at risk' of failing to meet its WFD objectives.

7.147 The calcarenite bedrock in the south of the site is classified as a Locally Important Aquifer (Lm) and forms part of the Lusk GWB. This GWB achieved 'Good' WFD status (2016-2021) and is 'at risk' of failing to meet its WFD objectives.

7.148 Vulnerability of groundwater at the existing site is mapped to range from high vulnerability in the west to X (rock at or near surface or karst). However, based on site-specific data which reveals the presence of thick subsoils deposits (till and sands and gravel), the groundwater vulnerability at the site is likely to be moderate to high. No bedrock was encountered during the site investigations.

7.149 There are several private boreholes in the lands surrounding the site. The majority of the boreholes in the Duleek GWB have a poor yield, whereas the majority in the Lusk GWB have excellent yields. The boreholes are used for domestic and agricultural purposes, but several are also used for public water supply. The site is not located within a drinking water protection area.

7.150 The groundwater levels on the site range from 63.6mOD to 96.5m OD and groundwater flows to the south towards the Delvin River.

7.151 The Bog of the Ring pNHA is c. 4km to the east of the site, located in the Lusk GWB and in the same aquifer as the site. However, it is not groundwater fed and has been screened out of the impact assessment.

7.152 The North-West Irish Sea SPA has an indirect hydrological connection with the site via groundwater recharge, groundwater flow and the Delvin River. However, this SPA has not been included in the impact assessment due to the large volumes of water within this coastal waterbody, the saline nature of these waters and the length of the hydrological flowpath between the site and the SPA. There is no potential for the proposed development to impact the status of this designated site.

7.153 In addition, all other protected areas have been screened out of the impact assessment due to the lack of hydrological or hydrogeological connectivity with the site.

IMPACT ASSESSMENT

Evaluation Methodology

7.154 The impacts of the proposed development on the local surface water and groundwater environment are assessed in this chapter without any mitigation measures in place.

7.155 The methodology applied here is a qualitative risk assessment methodology in which the nature of the potential impacts are described in terms of the character, magnitude, duration, probability and consequence of the impact are considered.

7.156 The description of the potential impact is screened against the significance and sensitivity of the receiving environment to determine the significance of the impact.

7.157 This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the development. This approach allows effort to be focused on reducing risk where the greatest benefit may result.

7.158 The assessment of risk is based on a matrix on importance of attributes and magnitude of impacts. Various criteria tables outline the assessments for the likelihood and magnitude of hydrological and hydrogeological impacts; these can be found in **Appendix 7-D**.

7.159 In addition to their nature and significant, the potential impacts will be assessed in terms of their duration and whether they are direct or indirect impacts. Any cumulative effects associated with the potential impacts will be assessed.

7.160 The following sections describe the water management system to the implemented at the proposed development site and identifies the impacts of the proposed development on the hydrogeological and hydrological environments. It also assesses the likelihood of occurrence of each identified impact in accordance with the above. It should be noted that the impacts are initially assessed with no mitigation or design measures incorporated to reduce the effects.

Proposed Water Management

Surface Water Runoff

7.161 Rainfall across the extraction areas will percolate naturally to the ground as diffuse groundwater recharge and this is a standard water management measure in sand and gravel pits. The rainfall percolates naturally to the groundwater as is the current situation at the existing greenfield site. The storm runoff will be contained within the working areas and the water may be used for site operations as required.

7.162 During extreme storm events surface water runoff across the working areas will be managed before the water infiltrates to ground; storm water management during extreme weather events is a standard requirement in the operation of sand and gravel pits. Kilsaran operate numerous sand and gravel pits across the country and have many years of experience in the management of storm water at their sites.

7.163 Storm water runoff may pond on the pit floor on a temporary basis prior to the water infiltrating naturally to the ground; however, no specific site measures or infrastructure are required for the management of this storm water within the pit prior to infiltration to the ground and draining to the south. Some extraction will occur below the local groundwater table, groundwater in these areas will continue to drain naturally to the south and there will be no requirement for active dewatering.

Interaction with the Existing Drainage Ditches

7.164 As described above, there are 2 no. open drainage ditches within the site which direct surface water runoff from the existing agricultural lands to the south and into the Delvin River. These drains are typically dry and only respond to high rainfall events.

7.165 2 no. sections of the drainage ditches will require removal over the course of the proposed development. Firstly, a section of the ENE to WSW orientated ditch will be removed as extraction advances from Phase 1 to Phase 2. The main drainage ditch, oriented NW to SE, which runs through the centre of the site will remain in place for the duration of extraction operations in Phases 1 and Phase 2. A section of this main drainage ditch will be removed as extraction advances from Phase 2 to Phase 3. During Phase 3 extraction operations and following final restoration, the main drainage ditch will be directed to the pit floor where water will percolate to ground. Any residual existing drainage ditches outside of the extraction area, and downstream of the cut off drain, will be isolated from the cutoff drain (by a clay plug), and will not therefore act as a pathway from the development footprint to the Delvin River.

Aggregate Washing

7.166 The proposed development will use a CDE Aquacycle Thickener Unit or similar type of unit to recycle process water from the aggregate washing process for re-use and thus eliminate the requirement for settlement lagoons. A polyelectrolyte flocculant will be used to force fine particles to settle whilst the water on the top overflows the weir and is stored in a water tank before being re-circulated around the plant. There will be no discharge of wastewater from the plant. This is a closed system and only requires a 10% of supply of top-up water.

Construction Phase (Unmitigated Scenario)

7.167 The potential direct and indirect effects to groundwater and surface waters are discussed below in the context of the proposed development. The construction phase for the purpose of the proposed development is taken to include the upgrade of the existing agricultural entrance on the western side of the R108. In addition, a dedicated weighbridge will be installed along the internal access track.

Direct Effects

7.168 No direct effects are anticipated during the construction phase.

Indirect Effects

Potential Effects from the Accidental Release of Hydrocarbons

7.169 The upgrade of the existing agricultural entrance and associated works will be completed using earth-moving machinery. Such machinery are powered by diesel engines and operate using hydraulics. Unless carefully managed such plant and machinery have the potential to leak hydraulic oils or cause fuel leaks. The accidental release of these compounds into the environment have the potential to negatively impact water quality in the underlying bedrock aquifer and the downstream surface watercourses which are linked to the site via groundwater recharge and lateral groundwater flowpaths.

7.170 The pre-mitigation potential effect is considered to be an indirect, negative, slight, temporary, unlikely effect on downg-radient surface water quality and groundwater quality in the bedrock aquifer.

Potential Effects from the Entrainment of Suspended Solids

7.171 There is the potential for the generation of suspended sediment in surface water runoff during the construction phase. Earthworks associated with the upgrade of the agricultural entrance will be a potential source of sediment laden water. Such activities can result in the release of suspended solids to surface waters which could affect the water quality of downstream receptors. However given the limited footprint of the proposed works, and also the lack of any watercourses in the immediate vicinity of the agricultural entrance and the high rates of groundwater recharge in the local area the potential for effects is limited.

7.172 The pre-mitigation potential effect is considered to be an indirect, negative, slight, temporary, unlikely effect on down-gradient surface water quality and groundwater quality in the bedrock aquifer.

Potential Effects on WFD Status

7.173 The EU Water Framework Directive (2000/60/EC) requires that all member states protect and improve water quality in all waters, with the aim of achieving "Good" status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the Directive is not compromised. In the vicinity of the site the Delvin_020 SWB is of "Moderate" status while the underlying Duleek and Lusk Bog of the Ring GWBs are of "Good" status. The proposed development must not prevent these waterbodies from achieving "Good" status in the future.

7.174 Given the nature and short timeframe for the construction phase, any effects on the water environment will be temporary. There is no potential for the status of underlying GWBs to be affected given the scale of the proposed works in comparison the overall scale of the GWBs. The works will also not result in any significant effects on the surface water environment due to the lack of any direct hydrological connection between the work areas and nearby watercourses.

7.175 No significant effects on surface and groundwater will occur during the construction phase. Therefore, there is little potential to change the status of downstream SWBs or underlying GWBs.

7.176 The potential for effects on the WFD status of waterbodies is negligible.

7.177 A full WFD Compliance Assessment is included as **Appendix 7-F**.

Operational Phase (Unmitigated Scenario)

7.178 The operational phase of the proposed development comprises the extraction of the sand and gravel reserves which will be completed in line with best international practice. The extraction area covers c. 6.2ha and will be worked (extracted and restored) on a phased basis (Phases 1 to 3). Soil and topsoil will be stripped and stored for reuse in the restoration. All material extracted onsite will be processed on site and hauled to service the existing readymix concrete plant operated by Kilsaran on the eastern side of the R108.

7.179 Restoration of the extracted areas will be carried out at the earliest opportunity in tandem with the extraction operations with the final restoration proposals being completed once extraction operations have ceased. It is proposed to restore the extraction area to an agricultural after use using the topsoil which was temporarily stored during the extraction operations. All structures, plant, equipment and stockpiles will be removed from the site. If required land/field drainage measures will be put in place following restoration. No significant impacts on the hydrological and hydrogeological environment are expected during the restoration works.

Direct Effects

Potential Effects on Groundwater Vulnerability

7.180 The proposed development will involve the removal of soils and subsoils in the 3 no. phased extraction areas. This removal of material will increase the groundwater vulnerability rating of the underlying bedrock aquifers. Vulnerability is currently rated as high based on the site hydrogeological conditions (thick permeable sand and gravel subsoils).

7.181 The pre-mitigation potential effect is considered to be a direct, negative, moderate, irreversible, permanent, likely effect on the local groundwater vulnerability rating of the underlying bedrock aquifers during the operational phase.

7.182 However, the restoration of the extraction areas will have a slight positive effect in terms of reduced groundwater vulnerability at the end of each extraction phase when the stripped topsoil is placed back onto the extraction areas.

Potential Effects on Groundwater Levels

7.183 The final floor levels of the phased extraction areas range from c. 77 to 101mOD for Phase 1, c. 65 to 85mOD for Phase 2 and c. 67 to 80mOD for Phase 3. The floor of the extraction areas will follow the existing surface topography and will be sloped to the south within each of the phased extraction areas.

7.184 The monitoring of groundwater levels within the site have revealed that the water levels are highest in the north of the site and fall to the south towards the Delvin River. The maximum recorded water levels at the site range from 65.5mOD in the southeast at BH1 (in the Phase 2 extraction area) to 96.5mOD in the northwest at BH3 (in the Phase 1 extraction area).

7.185 Extraction will be predominantly above the local groundwater table however some extraction is proposed below the maximum recorded groundwater levels. No active dewatering of groundwater is proposed (no pumping) and due to the permeable nature of the subsoils and the sloping topography, it is considered that the sands and gravels will continue to drain naturally to the south. Any groundwater drainage will be temporary. The final floor levels of the sand and gravel pit have been designed to consider the maximum winter water levels and reduce the works below the water table. For example the proposed floor level in Phase 1 extraction area is shallowest in the north due to the higher groundwater levels in this area of the site.

7.186 The removal of the overburden may also result in a slight increase in recharge to the sand and gravel aquifer. During Phase 3 the main existing drainage ditch within the site will direct water onto the floor in the Phase 3 extraction area. This may result in a reduction in surface water runoff and a slight increase in groundwater recharge during storm events. Any change is likely to be minimal as these drainage ditches are typically dry. Greenfield runoff rates are very low and most rainfall falling at the site currently recharges to ground.

7.187 The pre-mitigation potential effect is considered to be a direct, negative, imperceptible, medium-term, likely effect on local groundwater levels.

7.188 Any potential minor groundwater level effects will only be temporary and will be undone following cessation of extraction and restoration of the extraction areas. Restoration with the previously stripped topsoil which will return recharge rates to the baseline conditions.

Indirect Effects

Potential Effects from Earthworks and the Removal of Overburden on Surface Water Quality

7.189 There will be requirement to strip and store soil and topsoil at the site. In addition, the sand and gravel subsoils will be removed from the 3 no. phased extraction areas. During extraction, overburden removal will be an intermittent process and will be done so as the pit faces are progressed to the north in Phase 1, to the south in Phase 2 and to the west in Phase 3.

7.190 These earthworks could have the potential to result in sediment entrainment in surface water runoff from the site. However, the site is characterised by high rates of groundwater recharge and low rates of surface water runoff. Furthermore, during the extraction phase there will be no discharge to surface waters and all water within the extraction areas will be discharged to ground (as per the greenfield conditions). The extraction areas will be bowl-shaped and water will be directed to the pit floor. The only potential pathway between the extraction areas and the Delvin River is via groundwater recharge, the lateral migration of groundwater and discharge to the river as baseflow. The natural sand and gravel subsoils at the site are excellent natural filters and will remove all suspended sediment from the groundwater prior to it reaching the Delvin River.

7.191 The greatest potential effects for surface water arise from runoff from the spoil storage areas. In an unmitigated scenario, there may be some sediment entrained in surface water runoff during storm events. This storm runoff could continue overland and discharge into the Delvin River without recharging to ground. Based on the existing baseline environment, runoff volumes during storm events will be small.

7.192 The pre-mitigation potential effect is considered to be an indirect, negative, slight, medium-term, unlikely effect on surface water quality.

Potential Effects from the Accidental Spillage of Oils and Fuels

7.193 Excavation of aggregate at the site will be completed using machinery. Such machinery are powered by diesel engines and operated using hydraulics. Unless managed carefully such plant and machinery have the potential to leak hydraulic oils or cause fuel leaks during refuelling operations.

7.194 Only small volumes of fuel/oils will be present on-site and therefore no significant effects are expected as long as standard mitigation is implemented.

7.195 The only potential pathway to surface waters will be via groundwater recharge, lateral groundwater migration and discharge as baseflow to the Delvin River.

7.196 The pre-mitigation potential effect is considered to be an indirect, negative, moderate, long-term, unlikely effect in surface water and groundwater quality in the bedrock aquifer.

Potential Effects on Groundwater Quality from Suspended Sediment

7.197 All sand and gravel will be excavated by the extraction by load, haul, dump method, this will increase the dust and suspended solids and could increase suspended solids in the groundwater which could in turn impact water quality in the underlying bedrock aquifers.

7.198 However, sand and gravel is an excellent natural filter and will remove all suspended sediment in groundwater.

7.199 The pre-mitigation potential effect is considered to be an indirect, negative, imperceptible, medium-term, unlikely effect on local groundwater quality in the bedrock aquifer.

Potential Effects on Surface Water Quantity

7.200 There will be no direct discharge to surface waters during the operational phase of the proposed development.

7.201 An indirect hydrological connection exists between the site and the Delvin River. This connection is associated with groundwater recharge and the lateral migration of shallow groundwater within the sand and gravel subsoils at the site. The increase in groundwater recharge due to the removal of soil and subsoil across the site could result in a very small increase in baseflow contribution from groundwater to the Delvin River.

7.202 Table 7-10 below presents a quantification of the changes in groundwater recharge associated with the proposed development. The quantitative analysis assumes that the baseline groundwater recharge at the site is currently c. 269mm/year (80% of the Effective Rainfall). In the existing baseline scenario, the total average volume of groundwater recharge across the proposed extraction area (6.2ha) is c. 45m^3/day. For the purposes of a conservative assessment it is assumed that 100% of the precipitation falling within the extraction area will recharge to ground. This equates to 57m^3/day across the extraction area and represents a 25% increase in recharge from the baseline scenario.

7.203 Table 7-11 also compares the baseflow volumes from the proposed extraction areas to the baseline flow and flood volumes in the Delvin River, assuming that all groundwater recharge will discharge as baseflow. These calculations have been completed for a range of subsoil permeabilities to account for the natural vertical and lateral variation in the glacial subsoils. The assessed permeabilities range from 1x10^{-4}m/s for clean sands and gravels to 1x10^{-6}m/s for a mixture of sands and silts. For these scenarios the baseflow will range from 1,440 to 14.4m^3/day. These baseflow volumes equate to a very small proportion of the overall flow in the Delvin River. The modelled Q_1 flow (flow that is exceeded 1% of the time) at the EPA Hydrotool Node 08_314 is 2.694m^3/s. Even in a worst case scenario whereby all of the subsoils at the site consist of clean and permeable sand and gravels, the baseflow to the Delvin River represents less than 1% of the Q_1 flow volume in the River. Note that flood flow volumes in the Delvin River associated with a 1 in 10-year, 1 in 100-year or 1 in 1,000-year flood events, will be significantly greater than the Q_1 flow. Therefore, the baseflow volumes from the site to the Delvin River will represent even lower percentages (than those in **Table 7-*11***) of the total volume in the river during these flood events.

7.204 Therefore, given the baseline hydrogeological regime (characterised by high rates of groundwater recharge and low rates of surface water runoff), the lack of any proposed surface water discharge, the small, proposed extraction area (6.2ha) in comparison with the total catchment area of the Delvin River, the proposed development will not significantly alter runoff or recharge rates and there will be no discernible impact on the downstream flood risk.

7.205 The pre-mitigation effect is considered to be an indirect, negative, imperceptible, medium-term, likely effect on surface water quantity.

Table 7-10
Quantification of Change in Groundwater Recharge Volumes

Scenario / Recharge Rates	GSI Baseline Scenario (80% GW Recharge)	Proposed Development Scenario (100% GW Recharge)
Effective Rainfall (mm/yr)	336	336
Groundwater Recharge (mm/yr)	269	336
Extraction Area (ha)	6.2	6.2
Total Recharge across Extraction Area (m^3/day)	45	57

Table 7-11
Quantification of Changes in Baseflow in Relation to Flood Flow Volumes in the Delvin River

Subsoil Permeability	$1x10^{-4}$ (m/s) Gravel & Sands	$1x10^{-5}$ (m/s) Clean Sands	$1x10^{-6}$ (m/s) Sands & Silt
$Q_{Baseflow}$ (m^3/day)	1,440	144	14.4
$Q_{Baseflow}$ (m^3/s)	0.0166	0.0016	0.0001
Q_1 Delvin River (m^3/s)	2.694	2.694	2.694
$Q_{Baseflow}$ as a % of Q_1	0.6%	0.005%	0.004%

Potential Effects on Local Groundwater Wells

7.206 Potential effects on the hydrogeological environment may have the potential to indirectly effect local groundwater well supplies.

7.207 However, there are no PWS or GWS located in the immediate vicinity of the site. The closest mapped PWS is the Bog of the Ring PWS. The outer source protection area associated with this supply is located c. 1km southeast of the site. The inner source protection area is mapped c. 2.2km to the east of the site. The proposed development has no potential to impact on this PWS as the Delvin River acts as a hydrological barrier between the site and this PWS. All groundwater within the site will follow surface topography and discharge as baseflow into the Delvin River.

7.208 In relation to private local groundwater wells, this impact assessment assumes that all local dwellings in the surrounding lands contain a private groundwater well supply.

7.209 There will be no quantitative risk to local groundwater wells as no active groundwater dewatering is proposed. The majority of the proposed extraction will be above the groundwater table and the permeable sand and gravel subsoils will continue to drain naturally. Furthermore, due to the permeable nature of the subsoils at the site, groundwater recharge rates will not be significantly altered by the proposed development. It is noted that the existing baseline conditions are characterised by low rates of runoff and high rates of groundwater recharge.

7.210 Similarly, effects on groundwater quality in local wells are considered to be unlikely for the following reasons:

- The potential for effects on local wells (on well yields and on groundwater quality) was a concern raised in the previous application. We address those concerns here.
- The ground to the north of the extraction areas rises significantly. As a result, there can be no effects on local groundwater wells associated with dwellings to the north of the site. Groundwater level monitoring has revealed that the groundwater levels at the site slope from north to south. Any groundwater recharge in the proposed extraction areas will migrate laterally in the sand and gravel deposits to the south and will eventually discharge as baseflow to the Delvin River. Therefore, dwellings to the north of the site are located up-gradient of the proposed extraction areas and there will be no potential for effects on these groundwater wells.
- The River Delvon is located to the south of the site. As a result, there can be no effects on local groundwater wells associated with dwellings to the south of the site. The closest dwellings to the south of the site are located c. 400m from the site. There are no dwellings located between the proposed extraction areas and the Delvin River. All dwellings are located to the south of this watercourse which acts as a hydrological boundary between the site and these properties. Groundwater within the site will discharge as baseflow to the Delvin River and there will be no effects on local private groundwater wells supplies to the south of the site.
- Observations recorded during various site walkover surveys have revealed the presence of a slight topographic low between the proposed extraction areas and the dwellings to the east of the site along the R108. The dwellings along the R108 to the east of the extraction areas stand at elevations of c. 72 to 78mOD. Topography in the intervening lands (the land between the proposed extraction areas and the R108) falls to c. 69mOD before it rises again further west in the proposed extraction areas. The presence of this topographic low will significantly reduce the potential for effects on any groundwater wells along the R108. Groundwater within the proposed extraction area will flow to the south and southeast and will not rise again towards the R108. Groundwater flow at the site is also to the south, so lateral impacts on groundwater levels will be negligible.
- With respect to the down-gradient wells identified in the previous 2019 well survey (R2, R3 and R4), these wells are shallow and located over 400m from the extraction area. Over this distance there is no potential to significantly effect the yield of groundwater wells or to effect groundwater quality.
- Several dwellings are also located along the L10703 to the west/southwest of the site. The closest dwelling is located c. 215m to the west of the site. However, as stated previously groundwater within the proposed extraction areas will flow to the south and southeast. Therefore, these dwellings along the L10703 are located up-gradient/across gradient of the site and there will be no water quality or drawdown effects.
- Furthermore, the local area is underlain by Poor and Locally Important bedrock aquifers and groundwater flowpaths in the local area will be short. Groundwater will discharge to the nearest surface water features, *i.e.* the Delvin River. There is no dewatering of the bedrock aquifer proposed as part of the development.

7.211 Based on the above, there will be little potential for effects on local groundwater wells.

Potential Effects on WFD Status

7.212 The potential surface water and groundwater effects are greater in the operational phase than in the construction phase described above. Therefore, there is greater potential for the operational phase to effect the WFD status of the SWBs downstream of the site and the underlying GWBs.

7.213 However, given the scale of the proposed extraction area (0.062km^2) in comparison with the overall size of the underlying GWBs (Lusk – Bog of the Ring GWB covers an area of 209km^2 while the Duleek GWB covers an area of c. 114km^2), there is little potential for the proposed development to alter the status of these GWBs even in the absence of mitigation measures.

7.214 Downstream surface water quality only has the potential to be impacted through groundwater recharge, the lateral migration of groundwater and eventual discharge as baseflow into the Delvin River. The greatest potential water quality effects would be associated with hydrocarbon spills/leaks as suspended sediment will be filtered by the sand and gravel deposits. Any change in surface water quantity associated with alteration of recharge and runoff rates will be small and will not change the quantitative status of downstream SWBs.

7.215 Therefore, there is no potential to affect the status of the underlying GWBs. Meanwhile the pre-mitigation potential effect on downstream SWBs is considered to be an indirect, negative, slight, medium-term unlikely effect.

7.216 A full WFD Compliance Assessment is included as **Appendix 7-F**.

Post-Operational/Final Restoration Phase (Unmitigated Scenario)

7.217 On cessation of extraction the land within the final phased extraction area (Phase 3B) be restored. In addition, the processing plant will be removed from Phase 1A and this area will be restored.

7.218 No significant impacts on the hydrological and hydrogeological environment are expected during the post-operational/final restoration phase. The final restoration will have a positive effect in terms of reduced groundwater vulnerability in Phase 1A and Phase 3B areas.

Significant of Potential Effects (Unmitigated Scenario)

7.219 The significant of the identified potential effects, in the absence of mitigation, are assessed here and shown in **Table 7-12** below.

Table 7-12
Summary of Pre-Mitigation Potential Effects

	Potential Impacts	Character of Effect	Magnitude of Effect	Duration of Effect	Probability of Effect	Consequences of Effect	Impact Rating
Construction Phase							
1	Impact on groundwater in bedrock aquifers from the accidental fuel leakage/ spillage	Potential to indirectly affect groundwater quality in underlying bedrock aquifers	Size and scale depend on volume of fuel Extent would be within and in the immediate vicinity of the site and immediate vicinity in Duleek GWB, and possibly a couple of kilometres in Lusk GWB	Temporary to short-term	Unlikely	Reduction in groundwater quality in underlying bedrock aquifers	High
2	Impact from the accidental fuel leakage/ spillage to groundwater and ultimately surface water	Potential to indirectly affect surface water quality through lateral groundwater migration	Size and scale depend on volume of fuel	Temporary to short-term	Unlikely	Reduction in downstream surface water quality	High
3	Impact on surface water due to sediment runoff from the upgrade of the existing agricultural entrance	Potential to affect surface water quality	Limited to immediate vicinity of the works due to their small scale	Temporary to short-term	Likely	Reduction in surface water quality	Medium
4	Impact on WFD status	Potential to indirectly affect the status of the underlying GWBs and downstream SWBs	Very limited potential due to the scale and nature of the works.	No change to WFD Status	Unlikely	Reduction in WFD Status	Low

	Potential Impacts	Character of Effect	Magnitude of Effect	Duration of Effect	Probability of Effect	Consequences of Effect	Impact Rating
Operational Phase – Impacts on Groundwater							
5	Impact on groundwater vulnerability rating due to the removal of soil and subsoils	Potential increase in groundwater vulnerability in underlying bedrock aquifers	Limited to within the proposed extraction areas	Medium-term	Likely	Increase in groundwater vulnerability in underlying bedrock aquifer	Low
6	Impact on groundwater levels	Potential increase in groundwater levels due to increased recharge associated with removal of overburden	Limited to within site as the current hydrogeological regime is characterised by very high rates of recharge and low rates of runoff.	Medium-term	Likely	Increase in groundwater levels	Low
7	Impact on suspended solids in groundwater (bedrock aquifer) due to extraction	Potential to affect groundwater quality	Local as ground acts as natural filter	Medium-term	Unlikely	Reduction in groundwater quality in supply wells	Medium

	Potential Impacts	Character of Effect	Magnitude of Effect	Duration of Effect	Probability of Effect	Consequences of Effect	Impact Rating
8	Impact on groundwater in bedrock aquifers from the accidental fuel leakage/ spillage	Potential to affect groundwater quality in underlying bedrock aquifers	Size and scale depend on volume of fuel. Extent would be site and immediate vicinity in Duleek GWB, and possibly a couple of kilometres in Lusk GWB	Temporary to short-term	Unlikely	Reduction in groundwater quality in underlying bedrock aquifers	High
Operational Phase – Impacts on Surface Water							
7	Impact on suspended solids in surface water due to extraction	Potential to affect surface water quality through groundwater recharge and lateral groundwater migration	Local as ground acts as natural filter	Medium-term	Unlikely	Reduction in surface water quality	Medium
10	Impact from the accidental fuel leakage/ spillage to groundwater and ultimately surface water	Potential to affect surface water quality through groundwater recharge and lateral groundwater migration	Size and scale depend on volume of fuel	Temporary to short-term	Unlikely	Reduction in surface water quality	High

	Potential Impacts	Character of Effect	Magnitude of Effect	Duration of Effect	Probability of Effect	Consequences of Effect	Impact Rating
11	Impact on downstream surface water quantity / flow volumes	Potential to affect surface water quantity due to a reduction in runoff rates associated with the removal of overburden.	Limited due to the natural hydrogeological regime which is characterised by high rates of recharge and low rates of runoff	Medium-term	Likely	Impact on surface water quantity	Low
Operational Phase – Impacts on Groundwater Well Supplies							
12	Impact on local private wells through a reduction in groundwater quality or change in groundwater quantity	Potential to indirectly affect local groundwater well supplies	The local topographical, hydrological and hydrogeological regime ensures that there is no potential for effects on local wells	No potential for effects	Unlikely	Impact on groundwater well supplies	High
Operational Phase – Impacts on WFD Status							
13	Impact on WFD status	Any change to surface or groundwater quality may have the potential to alter the WFD status of downstream SWBs or the underlying GWBs	Due to the nature of the proposed development there is limited potential for effects on SWBs. The primary receptor are the underlying GWBs.	Medium-term	Unlikely	Impact on WFD status	High

Unplanned Events

7.220 It is considered highly unlikely that any unplanned events with the site would result in a noticeable impact on the hydrology and hydrogeology of the local area.

7.221 Accidents at the site could result in the spillage or leak of fuels during quarrying activities. However, appropriate mitigation measures and monitoring are proposed below to ensure that there are no potential effects on the water environment as a result of unplanned events at the site.

7.222 The proposed extraction areas are not located within a floodplain and are therefore not considered to be at risk of flooding.

Transboundary Effects

7.223 The site does not cross any international boundaries, hence transboundary impacts are disregarded for this site.

'Do-nothing Scenario'

7.224 If the proposed sand and gravel extraction development is not permitted, the existing site will remain in agricultural use.

7.225 Groundwater vulnerability at the site would remain as High.

Cumulative Effects

7.226 There are no other quarries or pits in the immediate vicinity of the site. On the eastern side of the R108, the Kilsaran operate an existing batching plant, and there is also a soil recovery facility (Clashford Recovery Facility) beside the Kilsaran batching plant. The closest GSI mapped bedrock quarry is located at Bellewstown (operated by Kilsaran). This quarry is located c. 7.5km to the northwest of the site and is located at a sufficient distance away from the site to ensure that there will be no cumulative effects.

7.227 In addition, the EPA map 4 no. Section 4 discharges downstream of the site along the Delvin River at St. Claire's Nursing Home (DL 05/07) and City North Hotel (DL 05/10) in Stamullen, at Gormanstown College (DL 89/02) and at Gormanstown Wood Nursing Home (DL 13/03).

7.228 With all groundwater at the site flowing to the south and discharging as baseflow to the Delvin River, the only potential for cumulative effects is via the sites indirect connection to the Delvin River via groundwater. However, due to the relatively small-scale (6.2ha of proposed extraction areas) and nature of the proposed development (sand and gravel extraction predominantly above the groundwater table), there will be no significant alteration of the existing hydrogeological regime (i.e. there will be no significant change in runoff or recharge rates) and there will be no requirement for a surface water discharge. For these reasons, and with the implementation of the prescribed mitigation measures, there will be no potential for cumulative effects on the hydrological environment during all phases of the proposed development.

Significance of Impacts

7.229 The significance of impacts (**Table 7-13** below) is based on the significance and sensitivity of the existing environment (**Table 7-9** above), and the description of identified potential impacts

(**Table 7-12** above). The significance of impact is determined from the classification of the significance of impacts in **Appendix 7-E**.

Table 7-13
Significance of Impacts

No.	Potential Impact	Impact Rating	Existing Environment Significance/ Sensitivity Rating	Significance of Impact
Construction Phase				
1	Impact on groundwater in bedrock aquifers from accidental fuel leakage/ spillage	**High**	Duleek GWB has a **low** attribute quality or value on a local scale Lusk GWB has a **medium** attribute quality or value on a local scale	**Slight**
2	Impact from the accidental fuel leakage/ spillage to groundwater and ultimately surface water	**High**	Delvin River has a **low** attribute quality or value on a local scale	**Slight**
3	Impact on surface water due to sediment runoff from the upgrade of the existing agricultural entrance	**Medium**	Delvin River have a **low** attribute quality or value on a local scale	**Slight**
4	Impact on WFD Status	**High**	WFD Status has a **high** attribute value.	**None**
Operational Phase – Impacts on Groundwater				
5	Impact on groundwater vulnerability rating due to removal of soil and subsoils	**Low**	Duleek GWB has a **low** attribute quality or value on a local scale Lusk GWB has a **medium** attribute quality or value on a local scale	**Moderate**
6	Impact on groundwater levels	**Low**		**Imperceptible**
7	Impact on suspended solids in groundwater due to extraction	**Medium**		**Imperceptible**
8	Impact on groundwater in bedrock aquifers from the accidental fuel leakage/ spillage	**High**		**Moderate**
Operational Phase – Impact on Surface Waters				
9	Impact on suspended solids in surface water due to extraction	**Medium**	Delvin River have a **low** attribute quality or value on a local scale	**Slight**
10	Impact from the accidental fuel leakage/ spillage to groundwater and ultimately surface water	**High**		**Moderate**

No.	Potential Impact	Impact Rating	Existing Environment Significance/ Sensitivity Rating	Significance of Impact
11	Impact on downstream surface water quantity / flow volumes	**Medium**		**Imperceptible**
Operational Phase – Impacts on Groundwater Well Supplies				
12	Impact on local private wells through a reduction in groundwater quality or change in groundwater quantity	**Medium**	Groundwater supply wells have a **medium** attribute quality or value on a local scale	**No potential for effects**
Operational Phase – Impacts on WFD Status				
13	Impact on WFD status	**High**	WFD Status has a **high** attribute value.	**No potential for effects on GWB status** **Slight potential for effects on SWB status**

MITIGATION MEASURES

7.230 Proposed mitigation measures to reduce potential impacts associated with the proposed development to acceptable levels with a low risk to the receiving environment are identified in this section. These measures are designed to either reduce the likelihood of an event occurring or reduce the magnitude of the consequences if the event does occur. These measures are in accordance with the "best practice / possible remedial measures" set out in Chapter 3.4 of the DoEHLG (2004) Quarries and Ancillary Activities: Guidelines for Planning Authorities.

7.231 The measures outlined below are designed to mitigate any adverse impacts on surface water and groundwater identified here through the sequential approach of:

i. Avoidance;
ii. Prevention;
iii. Reduction; and
iv. Remedy / Offsetting.

7.232 The majority of mitigation measures identified here seek to avoid, prevent and reduce any adverse impacts on surface water and groundwater.

Construction Phase

Mitigation Measures for the Potential Release of Hydrocarbons

7.233 The following measures will be implemented at the site to prevent leaks and/or spills during the construction phase, these are mitigation by **prevention**:

- No fuel will be stored on-site;
- All mobile machinery refuelling will be carried out using a mobile bowser;
- Drip trays will be used for all re-fuelling activities;
- All machinery maintenance and repairs will take off-site at the existing concrete batching plant facility;
- All plant will be regularly maintained and inspected daily for leaks of fuels, lubricating oil or other contaminating liquids;
- All petroleum-based products (lubricating oils, waste oils, etc.) will be stored on drip trays under cover to prevent pollution due to accidental leakages;
- Waste oil and grease containers will be stored under cover in storage container. Waste containers will be collected and disposed of by a suitably licenced contractor;
- An emergency spill response kit (with containment booms, absorbent materials and drip tray) will be available on-site to contain/ stop the migration of any accidental spillages, should they occur;
- Plant operators will be briefed during 'toolbox' talks and site induction on where the spill kit is kept and how and when it is deployed;
- Traffic management system at the site will reduce conflicts between vehicles, and the potential risk of collisions and associated fuel spills or oil leaks; and,
- Site speed limits will be implemented across the site to further reduce the likelihood and significance of collisions and hence the possibility of a fuel leak from such a collision.

Operational Phase

Mitigation Measures to Protect Groundwater Vulnerability

7.234 Soil stripping and restoration of worked out areas will be carried out on a progressive basis to reduce the vulnerability of the bedrock aquifer to possible contamination.

7.235 The main mitigation with respect to groundwater quality protection during the operational phase will be the employment of best practice measures with respect to oil usage and refuelling of plant and machinery.

7.236 Post extraction a restoration plan will be implemented which will involve the previously stripped soil being placed on the pit floor to establish grassland which will provide a level of protection to groundwater. Post restoration, the site will be returned to agriculture which will reduce the risk of illegal activities such as fly-tipping.

Mitigation Measures in Relation to Groundwater Levels

7.237 Some excavation is proposed below the local groundwater table. However, no significant volumes of groundwater will accumulate within the extraction areas as the proposed levels have been designed to reflect the water levels recorded at the site.

7.238 Where extraction occurs below the groundwater table, water will be directed to a sump on the pit floor and will be allowed to recharge naturally back into the ground.

Mitigation Measures to Prevent the Entrainment of Suspended Solids in Runoff

7.239 Mitigation measures proposed include the following:

- Overall surface water runoff from the site will be low due to the permeable nature of the soils and subsoils;
- Prior to any overburden stripping or extraction a shallow cut-off drain will be installed along the southern boundary of the site to prevent any site run-off which my potentially contain suspended solids from flowing over ground to the adjacent Delvin River. The proposed cut-off drain will run parallel to the river and will be between 40 and 50m from the river channel leaving a significant buffer zone between the drain and the river. Water within the cut-off drain will be discharged to ground;
- Soil stripping and restoration of worked out areas will be carried out on a progressive basis;
- The temporary soil / subsoil areas will be managed to minimise the risk of rain / wind erosion;
- Daily monitoring of the overburden stripping and soil storage areas will be completed by a suitably qualified person. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter will enter the downstream receiving waters;
- Overburden stripping and landscaping works will be scheduled for periods of low rainfall (summer months) to reduce run-off and potential siltation;
- Recently restored areas and temporary soil/overburden storage berms will be grass seeded as soon as possible after formation to reduce the potential of surface water erosion;
- Drainage controls are proposed along the internal haul road (refer to Drawing 12); and,
- Good construction practices such wheel washers and dust suppression on site roads, and regular plant maintenance will ensure minimal risk. The Construction Industry Research and Information Association (CIRIA) provide guidance on the control and management of water

pollution from construction sites ('Control of Water Pollution from Construction Sites, guidance for consultants and contractors', CIRlA, 2001), which provides information on these issues. This will ensure that surface water arising during the course of overburden stripping and landscaping activities will contain minimum sediment.

Mitigation Measures for Hydrocarbons

7.240 During the operational phase the mitigation measures implemented to prevent the release of hydrocarbons will be the same as those for the construction phase detailed above.

Mitigation Measures to Protect Groundwater Quality from Suspended Solids

7.241 No specific mitigation measures are required due to the excellent filtration capacity of the sand and gravel subsoils at the site.

Mitigation Measures to Protect Surface Water Quantity

7.242 No specific mitigation measures are required as the proposed development does not significantly alter the existing hydrogeological regime or the existing rates of groundwater recharge and surface water runoff.

7.243 A quantitative assessment has been completed for a range of flood scenarios, and for a range of subsoil permeabilities, which demonstrates that the baseflow contribution from the extraction area to the Delvin River is insignificant in comparison with the flow volumes within the river itself.

7.244 Based on the above, even in the absence of mitigation measures there will be no change in the quantitative status of downstream watercourses and there will be no increase in the downstream flood risk.

Mitigation Measures for Local Groundwater Wells

7.245 As detailed above there is little potential for effects on local groundwater well supplies due to the local hydrogeological regime, groundwater flow directions (southerly groundwater flow), topographical features (valley to the east) and hydrological barriers (Delvin River to the south).

7.246 Nevertheless, mitigation measures have been prescribed above in relation to hydrocarbons which will ensure that there is deterioration in local groundwater quality.

7.247 The previous RFI request states that "*the applicant shall submit details of remedial actions which they will undertake in the event that quarry activities impact the existing wells in the locality*". There is no potential for the quantitative status of groundwater wells to be impacted by the proposed development as no active dewatering is proposed. For the reasons detailed above, there is no potential for effects on the qualitative status of local groundwater wells. Kilsaran would like to offer additional reassurance and peace of mind to local domestic well owners by committing to replace their water supply or undertake remedial measures should a well be affected by the development. However, the assessment presented in this EIAR, combined with the prescribed mitigation measures, considers that there is potential for no potential for effects on local groundwater wells. The offer is being made solely from good will and does not cast doubt upon the assessment presented in this chapter.

Mitigation Measures to Protect WFD Status

7.248 The mitigation measures detailed above for the protection of surface and groundwater quality and quantity will ensure that the proposed development is compliance with the objectives of the Water Framework Directive.

Post – Operational Phase and Unplanned Events

7.249 Post operational, the site will return to an agricultural use, including re-instatement of hedgerows in locations similar to those which will be removed, to facilitate the development.

7.250 The scheme includes removal of all plant and machinery within the site.

7.251 There are no direct impacts anticipated from the post-operational phase, hence mitigation measures are not required.

RESIDUAL IMPACT ASSESSMENT

Construction Phase (Post Mitigation)

7.252 No significant effect in the water environment will occur during the construction phase due to the short-term and temporary nature of the works along with the prescribed mitigation measures regarding the use of hydrocarbons at the site. Without mitigation measures, there are no anticipated impacts that are likely and also significant.

7.253 It is considered that there are no residual adverse impacts on surface water and groundwater during the construction phase.

Operational Phase (Post Mitigation)

Potential effects on Groundwater Vulnerability

7.254 The application of best practice methods with regard oils and fuels and the proposed restoration plan, the residual effect on groundwater vulnerability rating will be negative, irreversible, slight, direct, likely, permanent effect.

Potential Effects on Groundwater Levels

7.255 Due to the nature of the local hydrogeological regime (sloping topography and high rates of groundwater recharge) and the nature of the proposed development (dry working with all extraction proposed above the winter groundwater level) the residual effects on groundwater levels will be negative, imperceptible, direct, likely, permanent effect.

Potential Effects from Earthworks and Removal of Overburden on Surface Water Quality

7.256 All site drainage/runoff water will be managed, contained and released to ground within the site thereby breaking the direct surface water pathway to local watercourses. The residual effect will be a negative, reversible, imperceptible, indirect, unlikely effect on surface water quality.

Potential Effects from the Accidental Spillage of Oils and Fuels

7.257 The potential for the release of hydrocarbons to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect will be negative, indirect, imperceptible, short term, unlikely impact to local groundwater quality and a negative, indirect, imperceptible, short term, unlikely impact to surface water quality.

Potential Effects on Groundwater Quality from Suspended Sediment

7.258 All water within the site will recharge to ground, through the subsoil sands and gravels. These granular subsoils are excellent natural filters and will prevent suspended sediment entering the underlying bedrock aquifer. The residual effect is considered to be a negative, imperceptible, indirect, unlikely effect on groundwater quality.

Potential Effects on Surface Water Quantity

7.259 There will be no direct discharge to surface waters associated with the proposed development. The proposed development will not result in any significant change to groundwater recharge or surface water runoff rates. During extraction there may be a slight increase in recharge as the topsoil is removed, however greenfield runoff rates are currently very low. All recharge will enter the underlying overburden aquifer and will discharge to the Delvin River as per the baseline environment. These baseflow volumes are insignificant in comparison to the flow volumes in the Delvin River. Based on the above, there will be no residual effect on surface water quantity and there will be no increased downstream flood risk.

Potential Effects on Local Groundwater Wells

7.260 With implementation of the prescribed mitigation measures for the protection of surface and groundwater quality combined with the topographic, hydrological and hydrogeological setting of the site there will be no residual effect on local groundwater well supplies.

Potential Effects on WFD Status

7.261 With the implementation of the mitigation measures outlined above there will be no change in the GWB or SWB status in the underlying GWBs or downstream SWBs resulting from the proposed development. The proposed development will not result in the deterioration in the WFD status of any SWB or GWB nor will it jeopardise the attainment of good status in the future.

Post – Operational/Final Restoration Phase

7.262 There will be no residual effects on the hydrological and hydrogeological environment during the post-operational phase.

HOW PREVIOUS CONCERNS ARE ADDRESSED

7.263 This section details how the previous reasons for refusal with respect to the water environment (surface and groundwater) have been addressed in this EIAR chapter. Where appropriate this section refers to and reproduces text from the Inspector's Report (ABP-308009-20) in order to provide context for the reader.

Surface Water

7.264 The Inspector's Report for the previous application detailed several reasons for refusal relating to the hydrological (i.e. surface water) environment. For clarity, these reasons and how they are addressed within this EIAR chapter, are detailed below. All concerns raised by the Inspector in relation to the surface water environment have been comprehensively addressed and based on the impact assessment provided above, it can be concluded that there will be no significant effects on the surface water environment.

7.265 With respect to surface water quality, the Inspector referred to the "*migration of suspended solids and/or contaminants through the sand and gravel deposits to the River Delvin*".

The proposed development poses no risk to downstream surface water quality in terms of suspended solids for the following reasons:

- No extraction or siteworks are proposed within 50m of the Delvin River;
- The proposed development does not include any proposed discharge to surface waters;
- Surface water runoff from the site will be very low due to the permeable nature of the soils and subsoils and the bowl-shaped nature of the proposed extraction areas;
- The only pathway from the proposed extraction areas to the Delvin River is indirect and via groundwater recharge, the lateral migration of groundwater in the sand and gravel aquifer and the discharge of this groundwater as baseflow to the river;
- Sand and gravel deposits are excellent natural filters and will remove suspended sediment before the groundwater reaches the river. Using very conservative values for permeability (of the sand and gravel), flow gradient (slope), and porosity (of the sand and gravel deposits) we have calculated that it will take >4 days for groundwater to travel from the lower edge of the extraction area to the River Delvin. During this time that groundwater will have to travel through the tiny pore space of the sand and gravel deposits, and will therein be filtered and cleaned of any residual suspended load. In fact, that filtration is likely to occur within its first few meters of flow. There is no potential for groundwater with entrained sediment from the extraction area to emerge as baseflow at the banks of the River Devlin; and,
- Any small volumes of surface water runoff from the site will be captured by the proposed shallow cut-off drain which will be inserted along the southern boundary of the site. The water in this drain will recharge to ground and there will be no direct discharge to surface waters.

With respect to hydrocarbons, best practice mitigation measures for the storage and handling of hydrocarbons have been prescribed within this EIAR. These mitigation measures are the same as those which are currently being implemented at sand and gravel pits, quarries and construction sites across the country, and will ensure that there are no effects on downstream surface water quality.

7.266 The Inspector also previously raised concerns regarding "*the cut-off drain (no identified outfall) and redirection of internal ditches (to the pit floor)*". The Inspector's Report states that these were "*inadequately detailed and could lead to pollution of the river from sediment laden discharge from the site to ground or directly to the River Delvin*".

With regards to the field ditches:

- It is important to note that the existing field ditches at the site are predominantly dry and only contain water following periods of intense rainfall (this has been confirmed by inspection during numerous site visits);
- The redirection of these field ditches to the pit floor will not have a negative effect on surface water quality, as this aspect of the proposed development removes the existing direct hydrological pathway between the site and the Delvin River (this direct pathway only exists during storm events);
- Once the ditches have been redirected to the pit floor, only an indirect hydrological connection (via groundwater flow) will exist between the proposed extraction areas and the Delvin River; and,
- The storm-water, which was formerly conveyed downstream by these field ditches, and may have contained entrained suspended solids during high intensity rainfall events, will be discharged onto the pit floor and will have to migrate through the underlying subsoil sand and gravels prior to discharge to the river as baseflow. As stated previously sand and gravel subsoils are excellent natural filters and will remove suspended sediment before these groundwater flows discharge to the river.

With regards to the cut-off drain:

- A detailed drawing of the cut-off drain is included as Drawing 12;
- Given the low rates of existing surface water runoff at the site, this drain will not accumulate much water;
- Any small volumes of surface water runoff which may arise during soil stripping works or from the soil storage areas will be captured by this cut-off drain which will prevent direct runoff from the site to the Delvin River; and,
- No outfall is required and water within this drain will essentially recharge to ground in a similar manner to the water within the extraction areas, i.e. as the underlying subsoil is permeable sand and gravel.

7.267 There was also concern around the sizing of the previously proposed settlement lagoons. However, the proposed development has been amended and will use a CDE Aquacycle Thickener Unit or similar type of unit to recycle process water from the aggregate washing process for re-use and thus eliminate the need for traditional settlement lagoons at the site. Small settlement lagoons will be used to treat water from the CDE Unit, allowing fine sediment to settle before the water is recirculated back to the washing-plant. The material removed from the settlement ponds will be used in the restoration.

7.268 In terms of the potential effects on flooding, the Inspector's Report with regard to the previous EIAR states that "*the risk of increased baseflows in the river is stated to be a 'likely' effect of the development, with the effect discounted to 'slight'*" and that there "*is no explanation of how the discounting has been arrived at or how the proposed development may influence the frequency or extent of flooding*". This EIAR concludes that the proposed development has no potential to impact the downstream flood risk for the following reasons:

- The lack of any proposed surface water discharge or abstraction means that there is little potential for the proposed development to alter the quantitative status of downstream watercourses;
- The proposed development will not significantly alter the existing hydrogeological regime which is characterised by high rates of groundwater recharge and low rates of surface water runoff;
- A quantitative analysis (refer to Sections 7.202 and 7.203) has shown that any increase in groundwater recharge at the site, associated with the removal of the topsoil, will result in a small increase in groundwater recharge; and,
- A quantitative analysis has also shown (refer to Sections 7.202 and 7.203) that the baseflow contribution from the site, in the existing baseline and proposed development scenarios, accounts for only a very small proportion of the total flow volumes in the Delvin River.
- A Flood Risk Assessment for the proposed development is included as **Appendix 7-H**.

7.269 The Inspector's Report also raised concerns regarding the potential effects associated with the construction phase works associated with the haul road (internal access track). The Inspector noted that "*the proposed internal haul road lies north of the River Delvin and is separated from it by at least 35m of agricultural land. At this distance, significant risks to the River Delvin from water arising from the use of the road are unlikely but the matter could be further addressed*". The proposed development has been amended to include drainage details along this internal access track which will ensure that there is no potential for surface water quality effects. These drainage details are provided in Drawing 12. Also refer to Para 2.95 (Chapter 2).

7.270 Furthermore, the assessment concludes that with the implementation of the prescribed mitigation measures, there will be no change in the WFD status of downstream SWBs as a result of the proposed development (Refer to **Appendix 7-F**).

Groundwater

7.271 The Inspector's Report for the previous application detailed several reasons for refusal relating to the hydrogeological (i.e. groundwater) environment. For clarity, these reasons and how they are addressed within this EIAR chapter, are detailed below. All concerns raised by the Inspector in relation to the groundwater environment have been comprehensively addressed, and based on the impact assessment provided above, it can be concluded that there will be no significant effects on the groundwater environment.

7.272 With respect to potential effects on groundwater quality arising from accidental spillages, the loss of the protective surface layer of topsoil and the increased sedimentation, the Inspector's Report states that the previous EIAR's "*conclusion in respect of no significant effects, are predicted on on-going protection of the bedrock aquifer by a clay layer and the adoption of standard practices to minimise the risk of accidental contamination*". This EIAR concludes that there will be no significant effects on groundwater quality for the following reasons:

- There is no potential for suspended solids to impact on groundwater quality in the underlying bedrock aquifer as all water recharging to ground at the site will pass through the natural sand and gravel subsoils which are excellent natural filters;
- With respect to the hydrocarbons, best practice mitigation measures for the storage and handling of hydrocarbons have been prescribed within this EIAR. These mitigation measures are the same as those which are currently being implemented at sand and gravel

pits, bedrock quarries and construction sites across the country, and will ensure that there are no effects on downstream surface water quality;

- Whilst the site investigation data does indicate the presence of glacial till subsoils in some areas of the site, the assessment presented in this EIAR does not rely upon the presence of a continuous subsurface clay layer protecting the underlying bedrock aquifer. The assessment is conservative and assumes that the subsoils overlying the bedrock are predominantly permeable sands and gravels;
- No bedrock was encountered in any of the boreholes completed at the site which extended to depths of between 11.5 and 30mbgl. Therefore, even with the proposed removal of subsoils at the site, an adequate thickness of protective subsoils will remain over the underlying bedrock aquifer; and,
- The bedrock underlying the site comprises of Poor and Locally Important bedrock aquifer.

7.273 Furthermore, the Inspector's Report raised concerns in relation to the duration of the previously relatively short groundwater monitoring window which extended from April 2019 to July 2019. This EIAR presents groundwater level monitoring data for the site from January/February 2022 to May 2024. This 29-month monitoring period coincided with some of the wettest periods in recent years. In particular the autumn of 2022, the late summer and autumn 2023 and the spring of 2024 were particularly wet. As a result the groundwater level data presented in this EIAR includes the maximum winter water levels.

7.274 In relation to the potential effects on local groundwater well supplies, the Inspector's Report states that the previous well survey completed in 2019 did not include all wells in the vicinity of the site. It is important to note that the conservative assessment presented in this EIAR chapter assumes that all local dwellings have a private groundwater well supply regardless of whether a well was previously identified or not. There will be no effects on the quantitative status of local well supplies as no active dewatering is proposed. The assessment of potential qualitative effects on well supplies presented in this EIAR concludes that there is no potential for effects due to the physical, topographic, hydrological and hydrogeological setting of the site with respect to potential local well supplies.

7.275 The assessment concludes that with the implementation of the prescribed mitigation measures, there will be no change in the WFD status of the underlying GWBs as a result of the proposed development.

MONITORING

7.276 The following programme is proposed for the site to assess/ monitor the implementation of the mitigation measures at the site as outlined above and to ensure the development does not have an adverse impact on surface water and groundwater.

Surface Water

7.277 It is not proposed to discharge any site waters to the Delvin River and therefore the proposal poses no pollution potential to surface water. Notwithstanding this, the applicant would be agreeable to carrying out surface water sampling at a location upstream and downstream (i.e. SW1 and SW2 as shown on **Figure 7-2**) of the site on a bi-annual basis.

Groundwater

7.278 A number of groundwater monitoring wells have been drilled around the perimeter of the proposed extraction area. Continuous water level recorders have been installed in a number of those wells as indicated in Para 7.123 (i.e. BH1, BH2, BH3 and BH4 on **Figure 7-9**). This continuous on-site groundwater level monitoring will continue.

7.279 Groundwater levels will also be recorded on a quarterly basis in residences R2 and R16 (local domestic wells shown on **Figure 7-8**) subject to owner consent. As outlined in Para 7.201, there is no potential for the quantitative status of groundwater wells to be impacted by the proposed development as no active dewatering is proposed. Notwithstanding this Kilsaran are proposing to undertake monitoring in R2 and R16 (as well as the on-site monitoring wells).

7.280 It is proposed to undertake groundwater quality monitoring at BH1 (on-site monitoring well), and R2 (groundwater quality to the south of the site) and R16 (groundwater quality lateral to the site) subject to owner consent. Baseline groundwater samples will be taken prior to the commencement of works. The analysis will be undertaken by an accredited laboratory. Groundwater samples will be tested for the following parameters:

- Conductivity (µS/cm);
- pH;
- Total Petroleum Hydrocarbons (TPH) (mg/l);
- Petroleum Range Organic (PRO) (mg/l); and,
- Diesel Range Organics (DRO) (mg/l).

7.281 The results of the groundwater monitoring programme will be submitted to Meath County Council on a quarterly basis.

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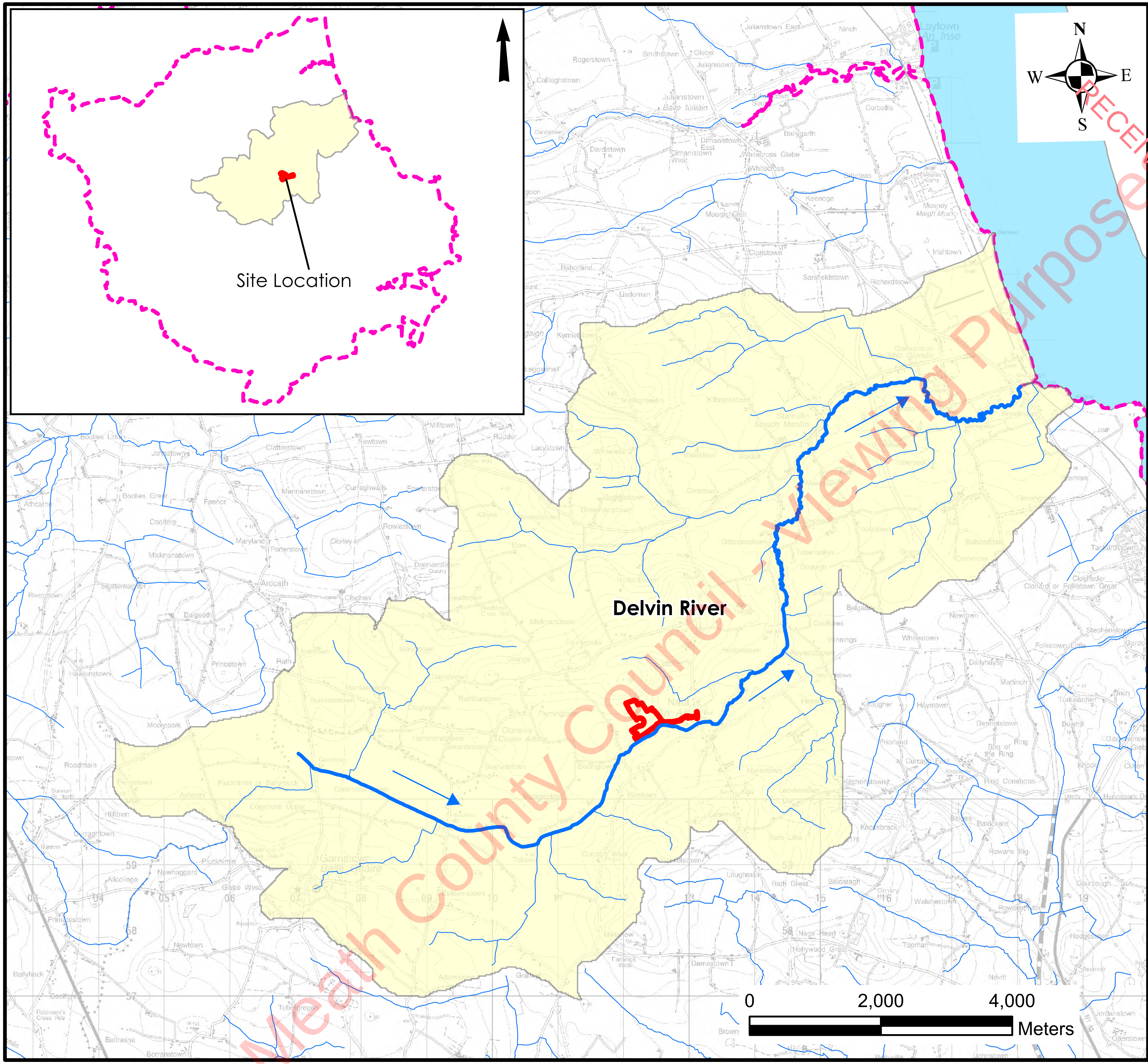
PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note).

FIGURES



Legend

Application Site Boundary

Watercourses

WFD Subcatchments

Delvin_SC_010

WFD Catchments

Nanny-Delvin

WFD Coastal Waterbodies

Northwestern Irish Sea (HA 08)

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Client: Kilsaran Concrete

Job: Naul, Co. Meath

Title: Regional Hydrology Map

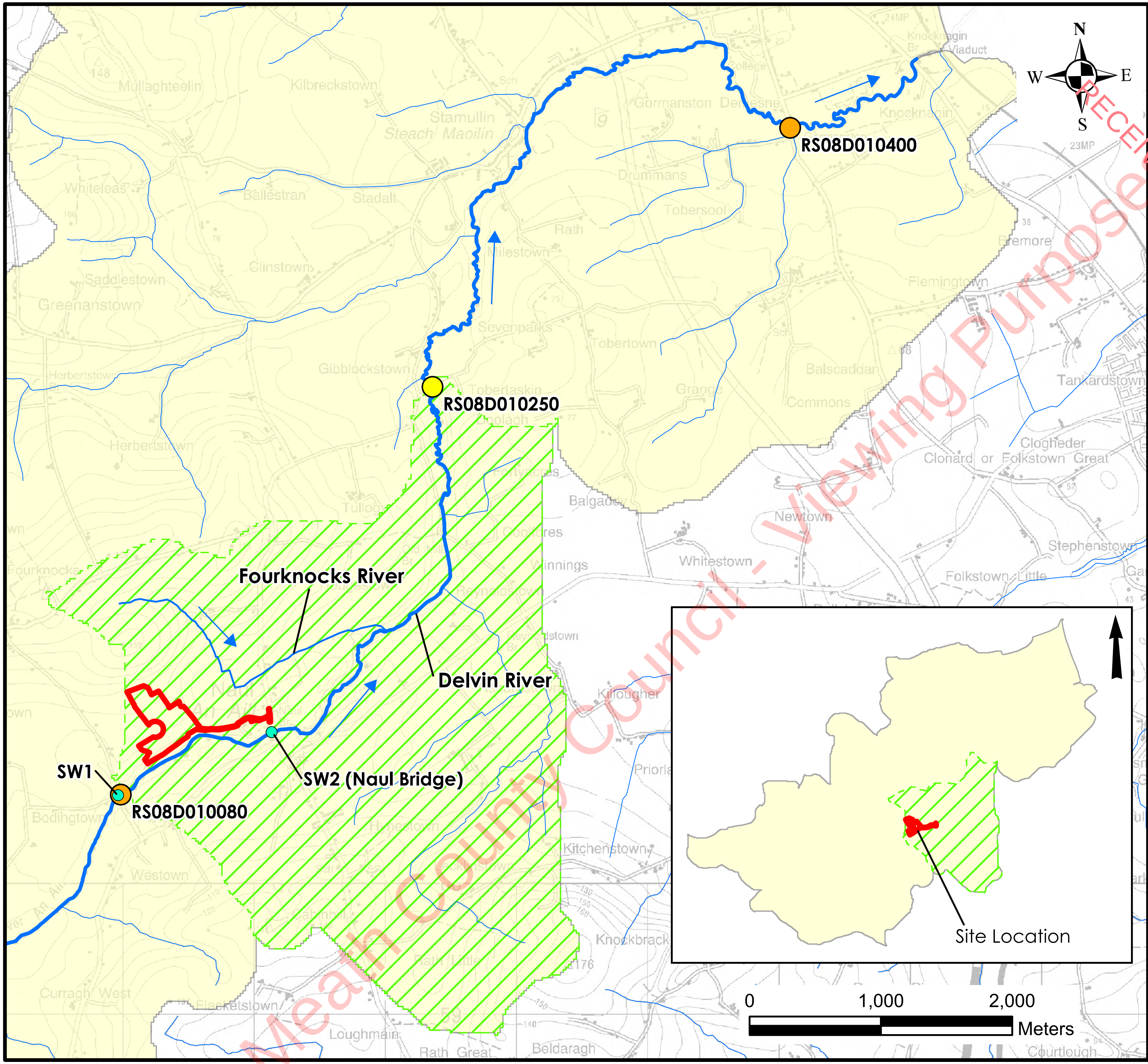
Figure No: 7-1

Drawing No: P1703-0-1024-A4-701-00A

Sheet Size: A4 | Project No: P1703-0

Scale: 1:80,000 | Drawn By: GA

Date: 15/10/2024 | Checked By: MG



Legend

- Application Site Boundary
- Watercourses

WFD River Sub-Basins

- DELVIN_020

WFD Subcatchments

- Delvin_SC_010
- Surface Water Sample Location

EPA Monitoring Stations

- Q3-4 (Moderate)
- Q3 (Poor)

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Client: Kilsaran Concrete

Job: Naul, Co. Meath

Title: Local Hydrology Map

Figure No: 7-2

Drawing No: P1703-0-1024-A4-702-00A

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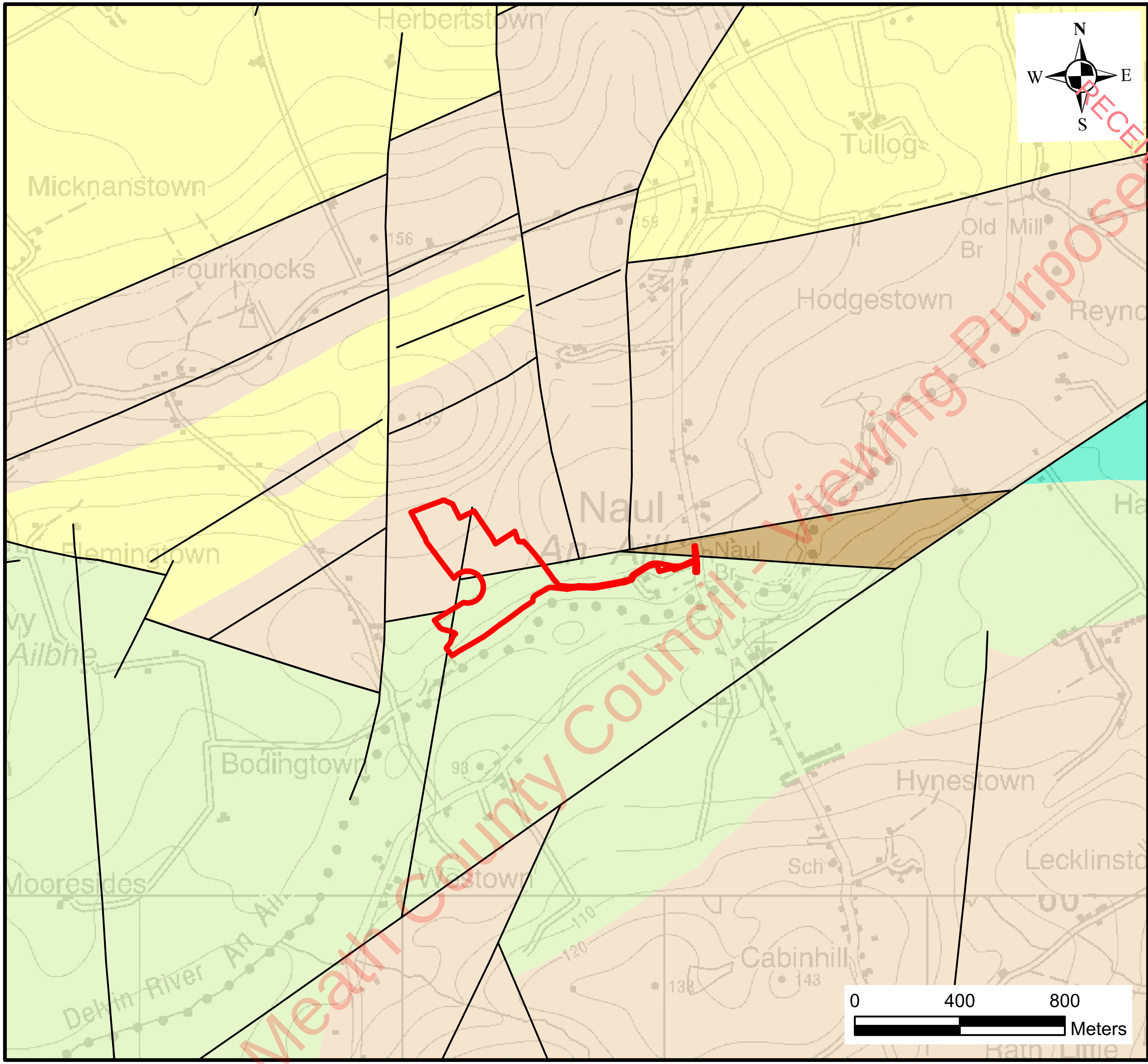

Legend

- Application Site Boundary
- Mapped Faults
- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Lk - Locally Important Aquifer - Karstified
- Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Pu - Poor Aquifer - Bedrock which is Generally Unproductive

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web: www.hydroenvironmental.ie

Client: Kilsaran Concrete

Job: Naul, Co. Meath

Title: Bedrock Aquifer Map

Figure No: 7-3

Drawing No: P1703-0-1024-A4-703-00A

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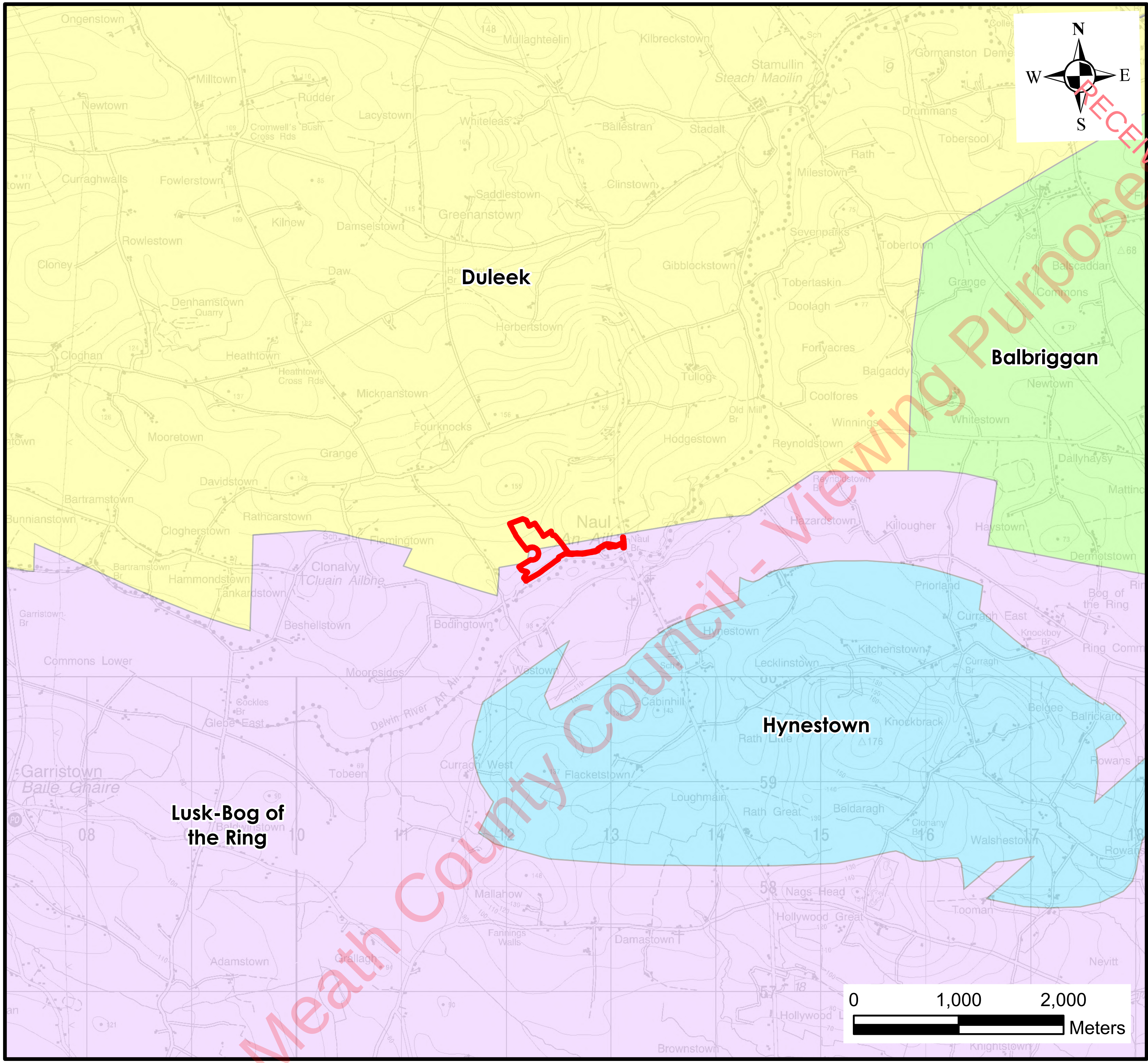
Date: 15/10/2024	Checked By: MG



Legend

- Application Site Boundary

Ground Waterbodies

- Balbriggan
- Duleek
- Hynestown
- Lusk-Bog of the Ring

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Client: Kilsaran Concrete	
Job: Naul, Co. Meath	
Title: Groundwater Bodies Map	
Figure No: 7-4	
Drawing No: P1703-0-1024-A4-704-00A	
Sheet Size: A4	Project No: P1703-0
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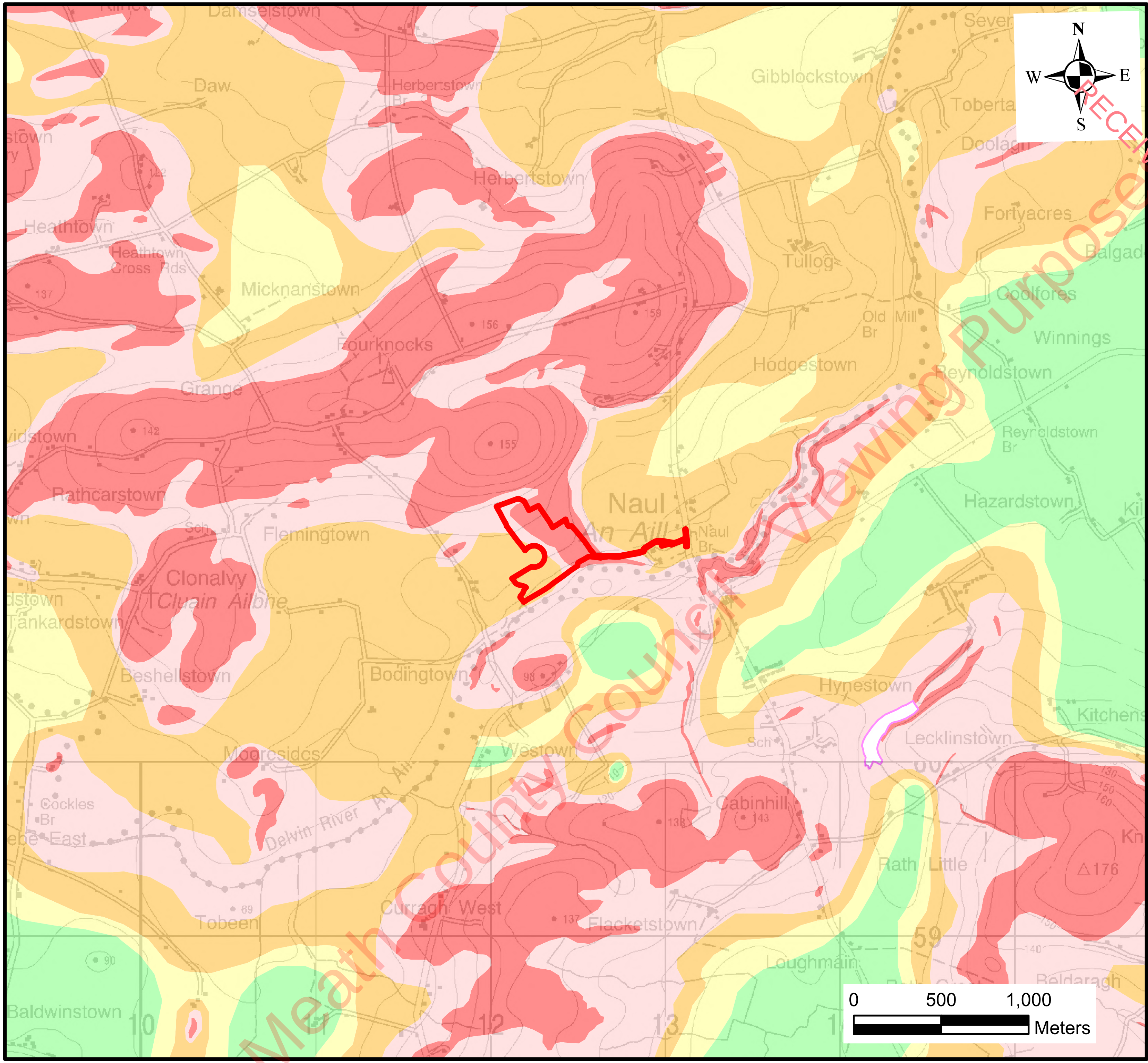

Legend

- Application Site Boundary

Groundwater Vulnerability

- Rock at or near Surface or Karst
- Extreme
- High
- Moderate
- Low
- Water

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Client: Kilsaran Concrete

Job: Naul, Co. Meath

Title: Groundwater Vulnerability Map

Figure No: 7-5

Drawing No: P1703-0-1024-A4-705-00A

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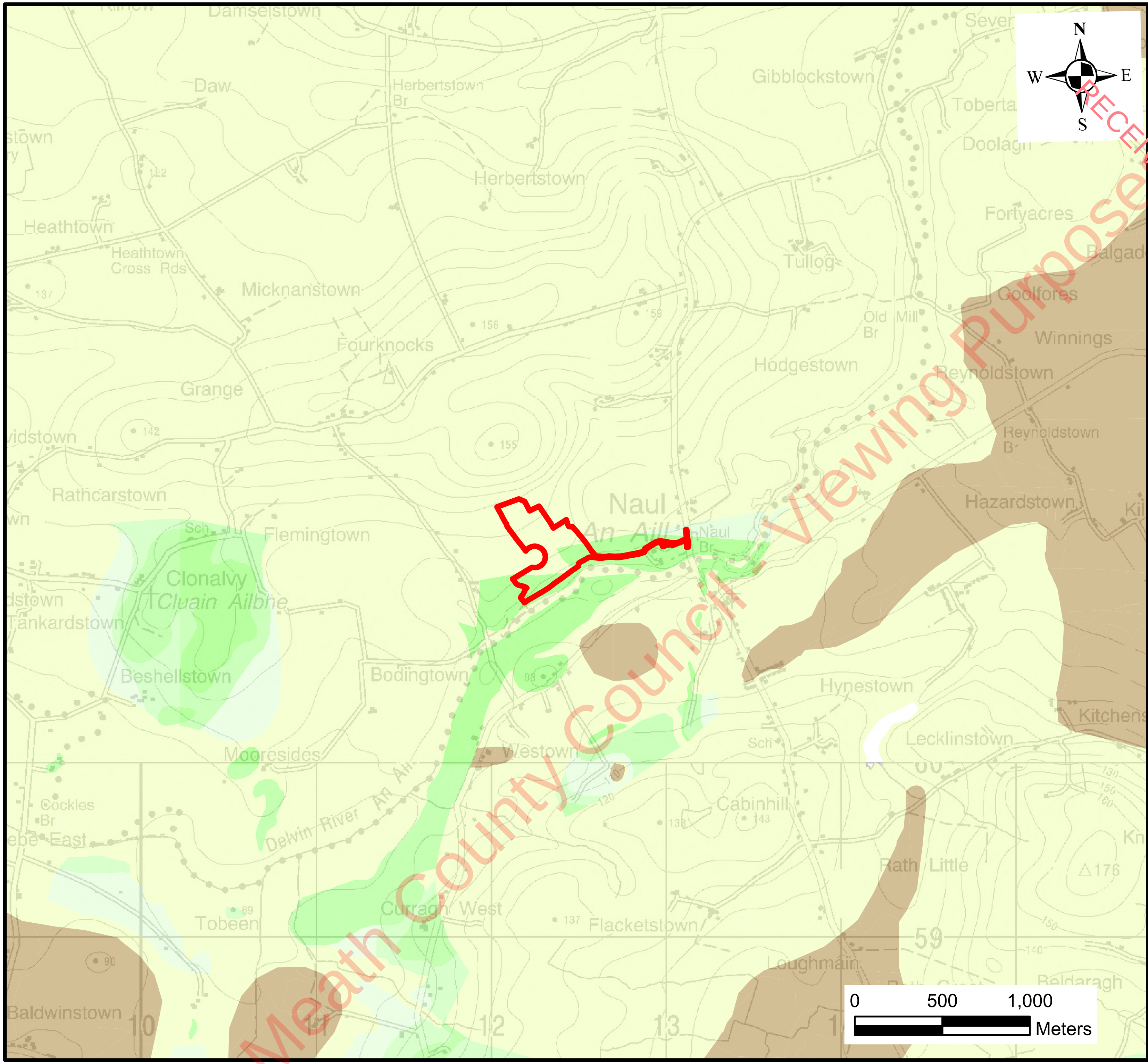
Date: 15/10/2024	Checked By: MG



Legend

Application Site Boundary

Groundwater Recharge

Annual Recharge (mm)

- 351-400 mm
- 301-350 mm
- 251-300 mm
- 201-250 mm
- 151-200 mm
- 101-150 mm
- 51-100 mm
- 1-50 mm

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Client: Kilsaran Concrete	
Job: Naul, Co. Meath	
Title: Groundwater Recharge Map	
Figure No: 7-6	
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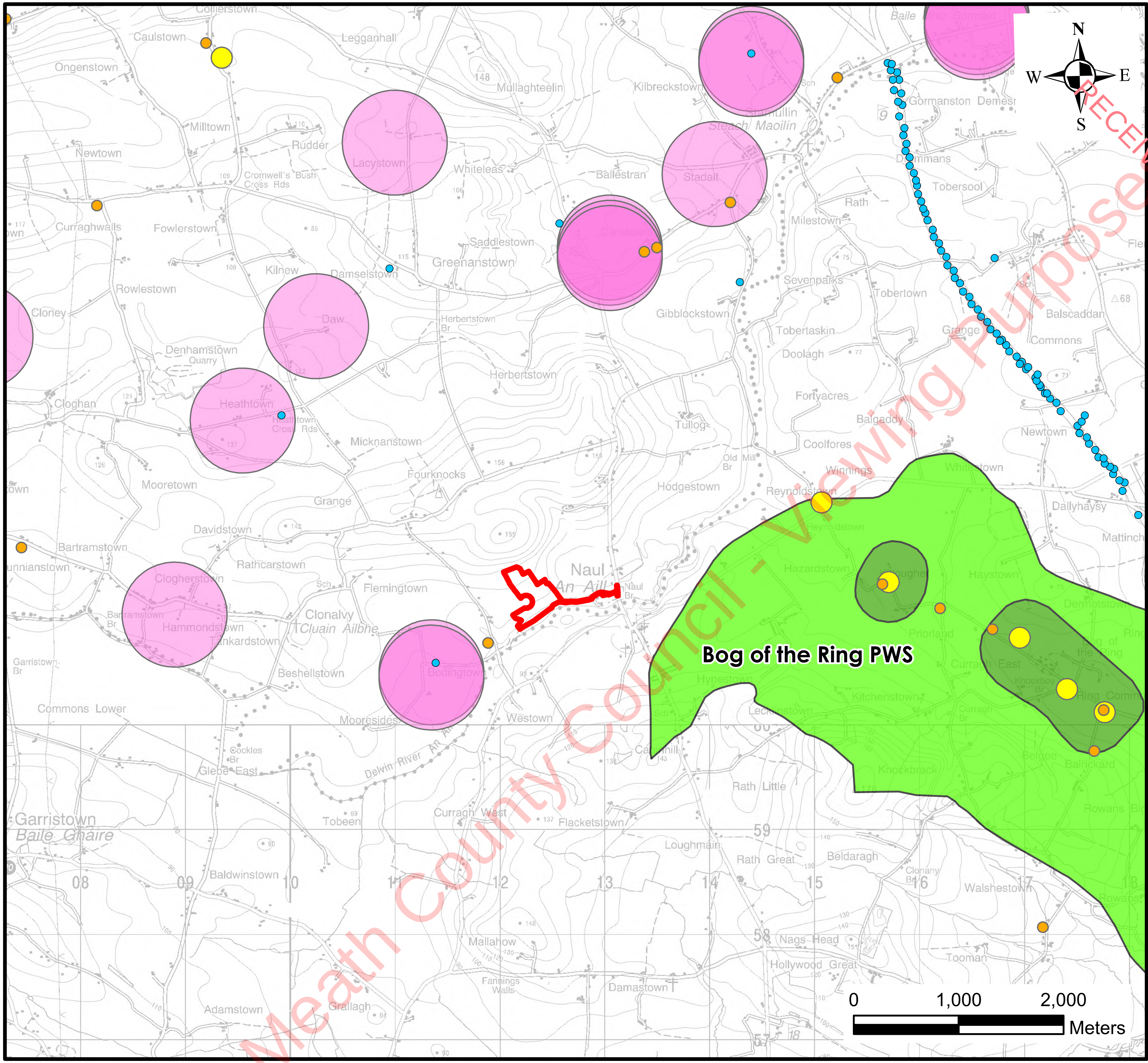

Legend

Application Site Boundary

GSI Mapped Wells

- Accuracy 1-50m
- Accuracy to 100m
- Accuracy to 200m
- Accuracy to 1km

Public Water Schemes

- SI-Inner Protection Area
- SO-Outer Protection Area

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Client: Kilsaran Concrete	
Job: Naul, Co. Meath	
Title: Groundwater Resources Map	
Figure No: 7-7	
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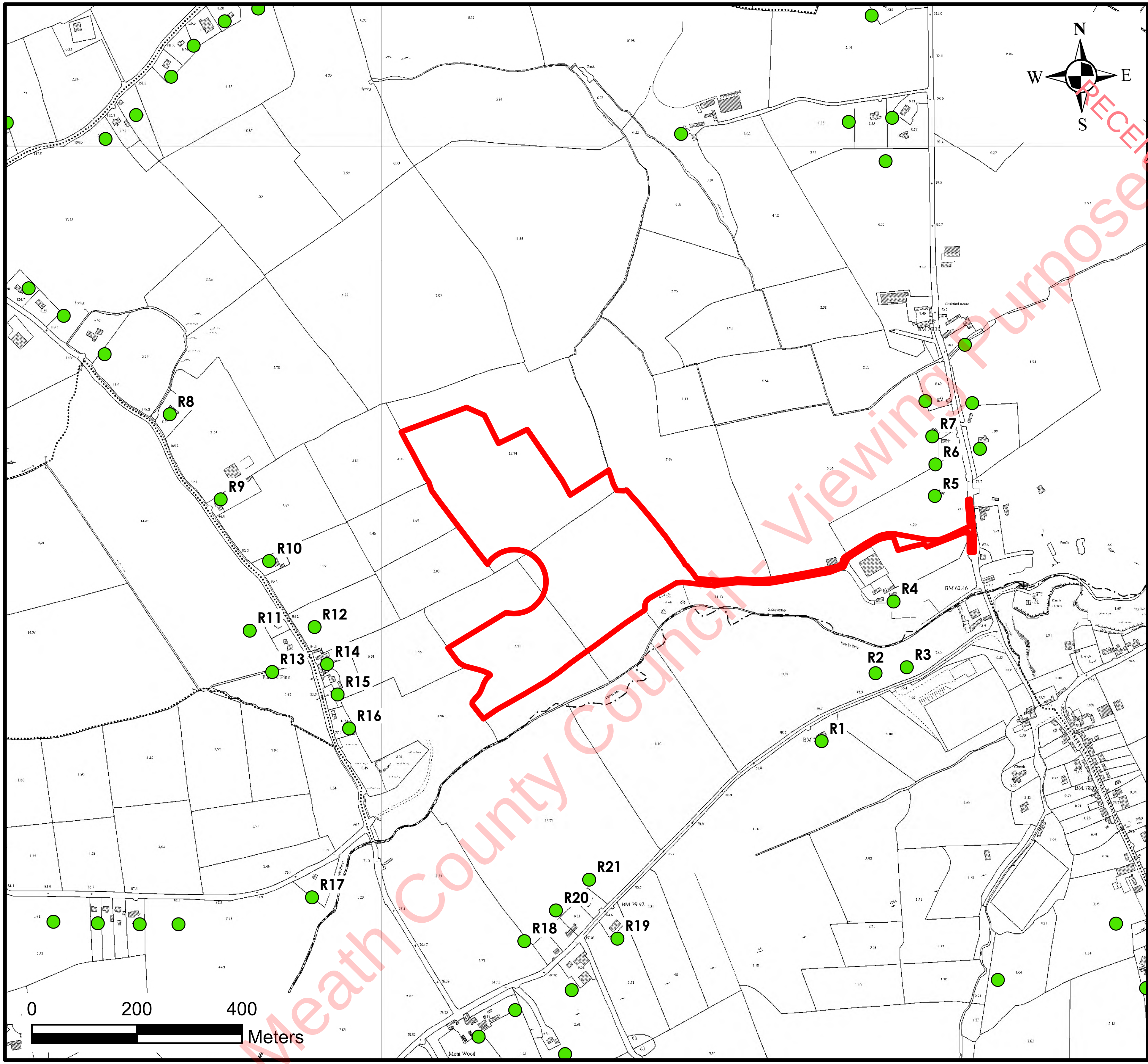
Date: 15/10/2024	Checked By: MG



Legend

Application Site Boundary

Private dwelling locations*

*R1-R21 - local well audit (SLR, 2019)

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Client: Kilsaran Concrete

Job: Naul, Co. Meath

Title: 2019 Well Survey Map

Figure No: 7-8

Drawing No: P1703-0-1024-A4-708-00A

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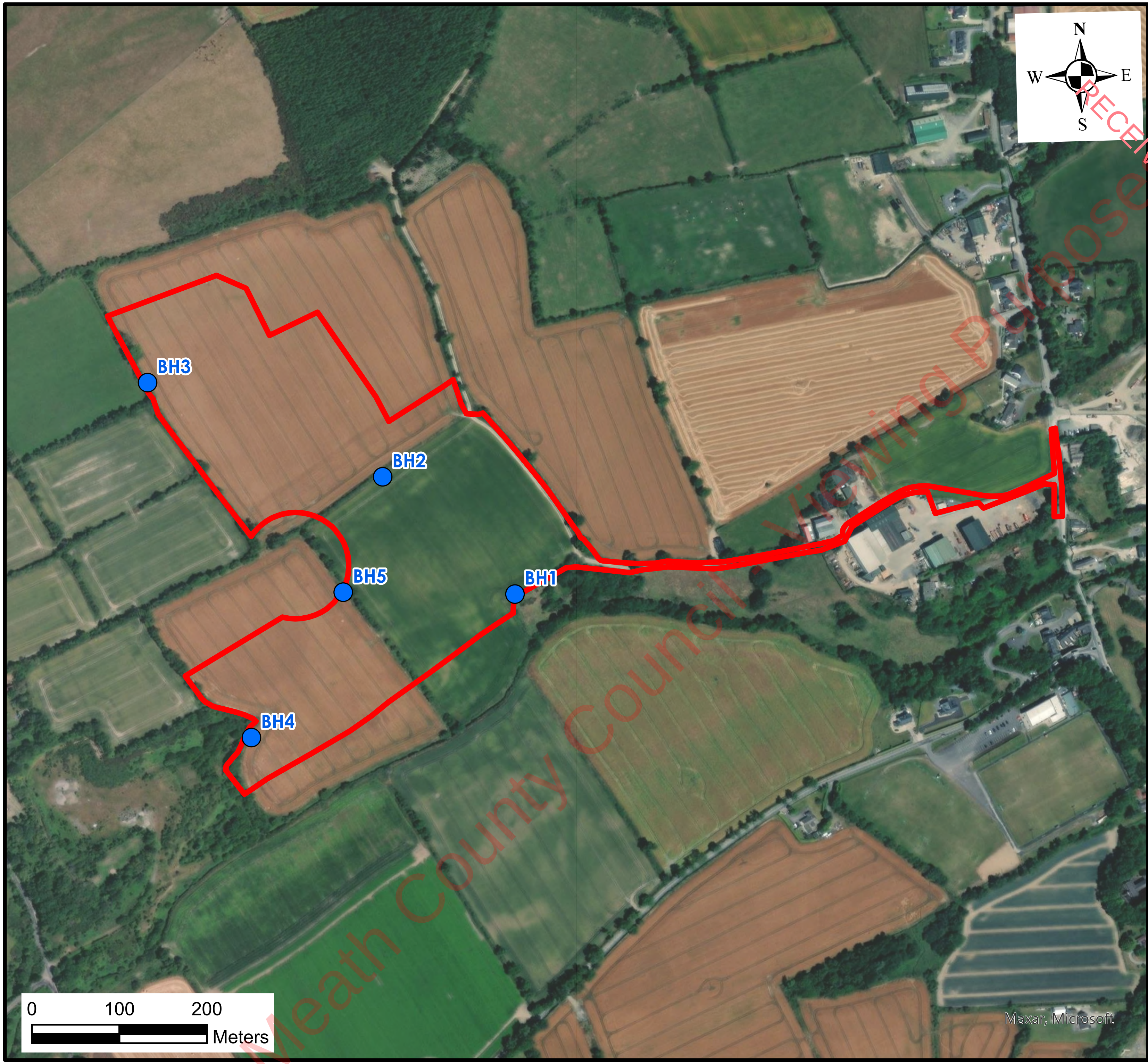
Date: 15/10/2024	Checked By: MG



Legend

Application Site Boundary

Monitoring Wells

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web: www.hydroenvironmental.ie

Client: Kilsaran Concrete	
Job: Naul, Co. Meath	
Title: Onsite Monitoring Wells	
Figure No: 7-9	
Drawing No: P1703-0-1024-A4-709-00A	
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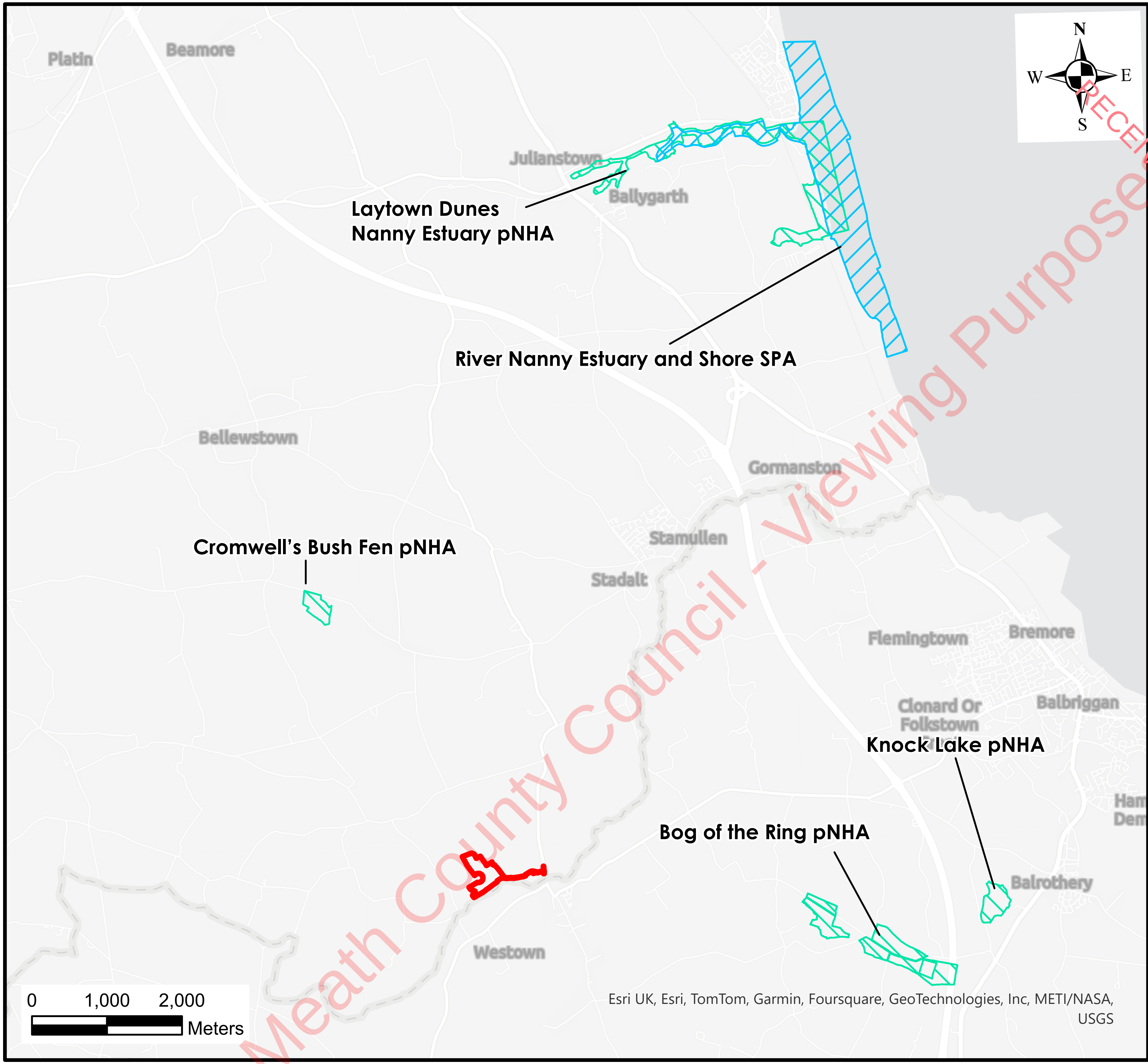
Date: 15/10/2024	Checked By: MG



Legend

- Application Site Boundary
- pNHA
- SPA

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Client: Kilsaran Concrete	
Job: Naul, Co. Meath	
Title: Designated Sites Map	
Figure No: 7-10	
Drawing No: P1703-0-1024-A4-710-00A	
Sheet Size: A4	Project No: P1703-0
Scale: 1:70,000	Drawn By: GA
Date: 15/10/2024	Checked By: MG

Appendix 7-A

EU Directives / National legislation and Regulations / Guidelines / Technical Standards

European Directives

- Environmental Impact Assessment. Directive (2011/92/EU) on the assessment of the effects of certain public and private projects on the environment;
- Environmental Impact Assessment Directive (2014/52/EU) on the assessment of the effects of certain public and private projects on the environment;
- Water Framework Directive (2000/60/EC);
- Groundwater Directive (2006/118/EC);
- Flooding Directive (2007/60/EC)
- Integrated Pollution and Prevention Control Directive (2008/1/EC); and
- The management of waste from extractive industries (2006/21/EC).

Irish Government Acts, National Legislation and Regulations

- S.I. No. 349 of 1989, European Communities (Environmental Impact Assessment) Regulations, and subsequent amendments (S.I. No. 84 of 1994, S.I. No. 352 of 1998, S.I. No. 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001);
- The Planning and Development Acts, 2000 to 2009, The Planning and Development (Amendment) Act 2010, S.I. 600 of 2001 Planning and Development Regulations and subsequent amendments including, S.I. No. 364 of 2005 and S.I. 685 of 2006.

National legislation on the protection of the water environment. Since 2000 water management in EU member states has primarily been directed by the Water Framework Directive (2000/60/EC) and the associate 'daughter' Groundwater Directive (2006/118/EC). Irish legislation implementing these, and other relevant directives currently includes:

- S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 and amendments (S.I. 389 of 2011 and S.I. 149 of 2012).
- S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009 and amendment (S.I. 327 of 2012);
- S.I. No. 684 of 2007 Waste Water Discharge (Authorisation) Regulations, 2007, as amended (S.I. 231 of 2010);
- S.I. No. 278 of 2007 European Communities (Drinking Water) (No. 2) Regulations;
- Water Services Acts 2007 and 2012;
- S.I. No. 722 of 2003 European Communities (Water Policy) Regulations;
- S.I. No. 122 of 2010 European Communities (Assessment and Management of Flood Risks) Regulations 2010;
- S.I. No. 457 of 2008 European Communities (Environmental Liability) Regulations which bring into force the European Liability Directive (2004/35/EC);
- European Union (Planning and Development) (Environmental Impact Assessment) (No. 2) Regulations 2018 (S.I. No. 404 of 2018);
- Local Government (Water Pollution) Acts 1977 to 1990;

- European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988);
- European Communities (Quality of Shellfish Waters) Regulations, 2006 (S.I. No. 268 of 2006);
- European Union (Drinking Water) Regulations 2014 (S.I. No. 122 of 2014);
- Bathing Water Quality Regulations, 2008 (S.I. No. 79 of 2008);
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010), and;
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610 of 2010).

Guidelines

- CIS (2007). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC) Guidance on preventing or limiting direct and indirect inputs in the context of the Groundwater Directive 2006/118/EC. Guidance Document No. 17.
- CIS (2010). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC). Guidance on risk assessment and the use of conceptual models for groundwater. Guidance document No. 26.
- DEHLG (2004). National Urban Waste Water Study. National Report.
- DEHLG (2009). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities.
- DELG/EPA/GSI (1999). Groundwater Protection Schemes. Document prepared jointly by the Geological Survey of Ireland (GSI), the Environmental Protection Agency, and the Department of Environment, Heritage and Local Government.
- EPA (Draft May 2017) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.
- EPA (2010b). Methodology for Establishing Groundwater Threshold Values and the Assessment of Chemical and Quantitative Status of Groundwater, Including and Assessment of Pollution Trends and Trend Reversal.
- EPA (2011). Guidance on the Authorisation of Discharges to Groundwater. Version 1, December 2011.
- EPA (2003). Towards Setting Guideline Values for the Protection of groundwater in Ireland. Interim Report.
- EPA (2006). Ireland Water Framework Directive Monitoring Programme.
- Fitzsimons, V., Daly, D. and Deakin, J. (2003). Draft GSI guidelines for assessment and mapping of groundwater vulnerability to contamination. Groundwater Chapter, Geological Survey of Ireland.
- GSI (2006). Criteria used in aquifer classification. 1Available from http://www.gsi.ie/Programmes/Groundwater/Aquifer+Classification.htm
- IGI (2007). Guidelines on Water Well Construction. Available from http://www.igi.ie/assets/files/Water%20Well%20Guidelines/Guidelines.pdf
- Kilroy, G., Dunne, F., Ryan, J., O'Connor, A., Daly, D., Craig, M., Coxon, C., Johnston, P. and Moe, H. (2008). A Framework for the Assessment of Groundwater – Dependent Terrestrial

Ecosystems under the Water Framework Directive. Environmental Research Centre Report Series No. 12.

- Institute of Geologists of Ireland, 2007. Recommended collection, presentation and interpretation of geological and hydrogeological information for quarry developments.

Technical Standards

- British Standards (1999). Code of Practice for Site Investigations BS5930. As amended.
- British Standards (2009). Water quality. Sampling. Guidance on sampling of groundwaters. BS ISO 5667-11:2009, BS 6068-6.11:2009. As amended.
- CIRIA (2007). The SuDS Manual. (C697). CIRIA publication, February 2007.

Appendix 7-B

Duleek and Lusk Groundwater Bodies

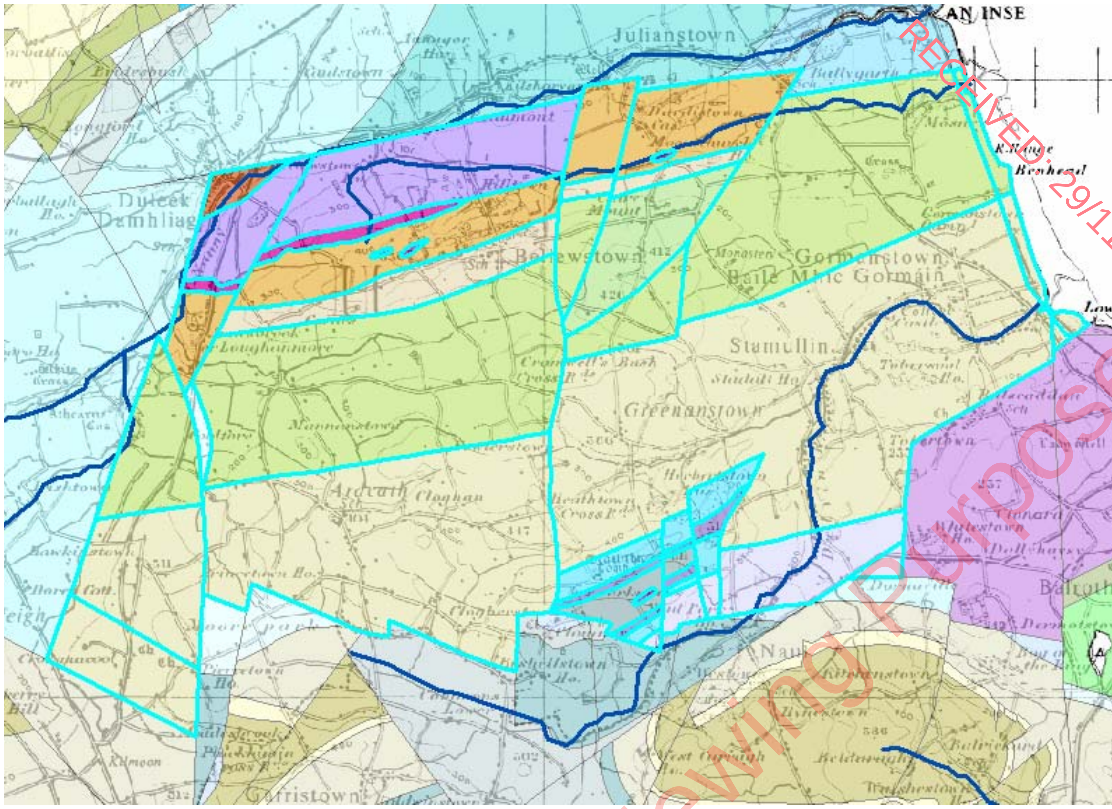
Duleek GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystems	Area (km^2)
Dublin Co. Co. Meath Co. Co. Hydrometric Area 08	Delvin, Mosney, Nanny, Hurley.	Cromwell's Bush Fen (1576), Laytown Dunes / Nanny Eastuary (554).	114

Topography		This GWB is located in north Dublin and extends into the east of Co. Meath. There are two areas of hilly topography, to the northwest at Bellewstown and to the south at Fourknocks. There is a sub catchment level drainage divide running roughly north south through this GWB. Water east of this divide enters the Irish Sea within the area of the GWB. Water to the west of this divide enters the River Nanny, which ultimately discharges to the Irish Sea in the adjacent Bettystown GWB.
Geology and Aquifers	Aquifer type(s)	**Pl:** Poor aquifer, generally unproductive except for local zones **Pu:** Poor aquifer, generally unproductive **Lm:** Locally important aquifer, generally moderately productive
	Main aquifer lithologies	Silurian and Ordovician Metasediments.
	Key structures.	The dominant structural feature within the Balbriggan Inlier is faulting of approximate north-south and northeast-southwest trends. There is evidence to suggest that the faulting along the southern boundary of the GWB has intensely deformed the rocks in this area, which may lead to local areas of more permeable rocks.
	Key properties	This aquifer is comprised of Lower Paleozoic rocks, which are commonly considered to be poor aquifers and transmissivities are presumed to be generally low (<10m^2/d).
	Thickness	The majority of groundwater flow will take place through the upper 3m of the aquifer in the broken and weathered rock zone. Major groundwater flows are not expected to be encountered below 10m of the surface. The majority of groundwater flow will take place in this upper section where the rocks is weathered and fractured.
Overlying Strata	Lithologies	There are a complex variety of subsoil lithologies in this area. The dominant type of subsoil is till: Irish Sea till in the east, which is surrounded in places by till derived from Lower Paleozoic rocks. These become less prevalent in the west where limestone-derived tills are more common. There is a large gravel deposit in the northeastern of this GWB at Gormanstown. Smaller sand and gravel deposits are mapped in the area of Skerries.
	Thickness	The subsoil thickness is influenced by the topography with thin or absent tills on the hills and thicker subsoils in between.
	% Area aquifer near surface	There is a large area to the west, in the hillier areas where the aquifer is close to the surface.
	Vulnerability	Vulnerability is Extreme in areas of higher elevations and generally Moderate inbetween these hills. There is a large area of High vulnerability in the northeast where the gravel deposits exist.
Recharge	Main recharge mechanisms	Diffuse recharge will occur via rainfall percolating through the subsoil. The proportion of the effective rainfall that recharges the aquifer is largely determined by the thickness and permeability of the soil and subsoil, and by the slope. Due to the generally low permeability of the aquifers within this GWB, a high proportion of the recharge will then discharge rapidly to surface watercourses via the upper layers of the aquifer, effectively reducing further the available groundwater resource in the aquifer.
	Est. recharge rates	*[Information to be added at a later date]*
Discharge	Springs and large known abstractions	There are no known large abstractions in this area. It is likely that in the near future a well in the Limestone to the south of this GWB may be used for public supply by Fingal Co. Co. Until long term monitoring is in place it is uncertain if this will have any impact on this GWB.
	Main discharge mechanisms	This aquifer will discharge to the overlying rivers and streams in the area as baseflow. The low permeability rocks in the area will no sustain large summer baseflows and it is more likely that the majority of groundwater flow will discharge to the rivers after a short lag time in the weathered zone of the aquifer. Additional discharge may enter the gravels located in the northeast of the area; more information is required to fully understand the relationship between the two aquifers. There may be some transfer of groundwater to the limestones in the south, this may increase in the future if large scale pumping of the limestone aquifer is commenced. The GWB will also discharge directly to the Irish Sea in some areas.
	Hydrochemical Signature	There is little hydrochemical analysis available for this GWB as there are no EPA monitoring sites located within it.
Groundwater Flow Paths		The majority of groundwater flow in this area is considered to take place in the upper weathered zone of the aquifer. Groundwater will flow from the recharge mounds in the north and south of the body towards the east and west of the area. Flow paths are not considered to extend further than the nearest surface water feature and will generally not be greater than 500m. Water level data suggest that the water table is generally within 5m of the surface.

Groundwater & surface water interactions	Cromwells Bush Fen Natural Heritage Area (NHA) is a small wetland lying some 6km southwest of Duleek in a pastoral/arable setting over poorly draining glacial drift. Large inland wetland areas are not a typical feature of the east midlands. Although small, this wetland contains a diversity of wetland habitats in transition that are unusual in the locality. Drainage and major nutrient input from adjacent land should be avoided on this site.
Conceptual model	This GWB is located in North Dublin and extends into the east of Co. Meath. There are two areas of hilly topography, to the northwest at Bellewstown and to the south at Fourknocks. The extent of the GWB is defined by the contact between the Lower Paleozoic rocks and the Limestone or in the southeast the volcanics. There is a sub catchment level drainage divide running roughly north south through this GWB. The GWB is composed primarily of low permeability rocks, although localized zones of enhanced permeability do occur. Rocks along the southern boundary of the GWB are expected to be highly deformed. There is evidence to suggest that the small area of volcanic rocks at balbriggan has a higher permeability than the other Lower Paleozoic Rocks. Recharge occurs diffusely through the subsoils and via outcrops. It takes place mainly in the upland areas where subsoils are thinner. The aquifers within the GWB are generally unconfined, but may become locally confined where the subsoil is thicker and/or lower permeability. Most flow in this aquifer will occur near the surface. In general, the majority of groundwater flow occurs in the upper 10 m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deep water strikes in more isolated faults/ fractures can be encountered at 30-50 mbgl. Flow path lengths are relatively short, and in general are between 30 and 300 m with groundwater discharging to the closest surface water feature.
Attachments	
Instrumentation	Stream gauge: 08016, 08017, 08020, Borehole Hydrograph: None EPA Representative Monitoring boreholes: None
Information Sources	K T Cullen & Co Ltd (1994) *Report on the Hydrogeological Investigation at the Bog of the Ring*. North County Dublin Groundwater Project. McConnell B, Philcox M & Geraghty M, 2001. *Geology of Meath: A geological description to accompany the bedrock geology 1:100,000 scale map series, Sheet 13, Meath*. Geological Survey of Ireland. 77 p. Woods L, Meehan R & Wright G R, 1998. *County Meath Groundwater Protection Scheme*. Report to Meath County Council. Geological Survey of Ireland. 54 p.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Formation Name	Code	Description	Rock Unit Group	Aquifer Classification
Carnes Formation	CC	Volcaniclastic greywacke and mudstone	Ordovician Volcanics	Pl
Clashford House Formation	CF	Mudstone & siltstone, andesite	Ordovician Metasediments	Pl
Clatterstown Formation	CW	Thinly bedded siltstone, sandstone	Silurian Metasediments and Volcanics	Pl
Denhamstown Formation	DD	Greywacke sandstone & siltstone	Silurian Metasediments and Volcanics	Pu
Diorite	Di		Granites & other Igneous Intrusive rocks	Pl
Fournocks Formation	FK	Banded red & green mudstone & siltstone	Ordovician Metasediments	Pu
Herbertstown Formation	HB	Andesite, tuff & mudstone	Ordovician Metasediments	Pu
Hilltown Formation	HT	Lapilli tuff, mudrock	Ordovician Volcanics	Pl
Kennetstown Formation	KT	Greywacke sandstone & siltstone	Silurian Metasediments and Volcanics	Pu
Mullaghfin Formation	MF	Pale peloidal calcarenite	Dinantian Pure Bedded Limestones	Lk
Old Red Sandstone (undifferentiated)	ORS	Red conglomerate, sandstone, mudstone	Devonian Old Red Sandstones	Ll
Prioryland Formation	PI	Green & purple mudrock, slump breccia	Ordovician Metasediments	Pu
Snowtown Formation	SW	Banded grey mudstone & siltstone	Ordovician Metasediments	Pl



AN INSE
Julianstown
Duleek
Damhliag
Bellewstown
Gormanstown
Baile Mhic Gormain
Stamullin
Greenanstown
Naul
Garristown

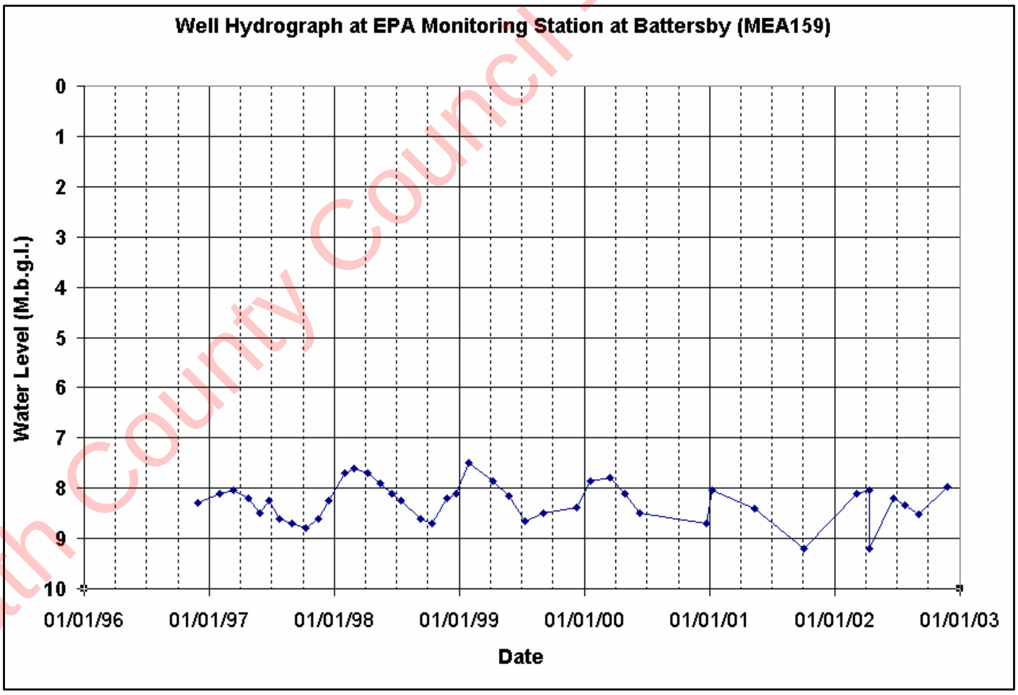
Lusk GWB: Summary of Initial Characterisation.

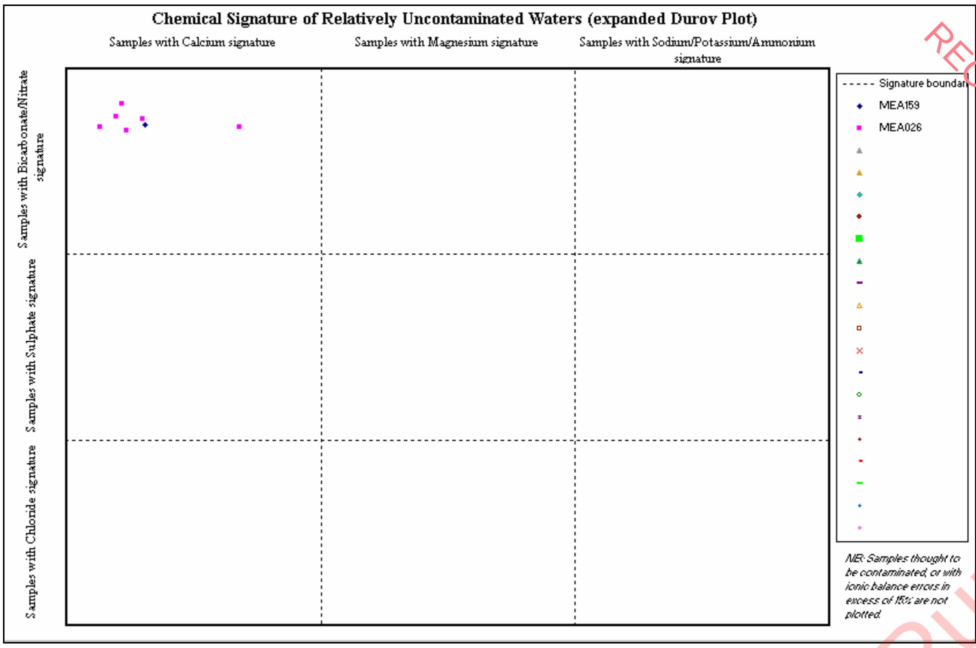
Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystems	Area (km^2)
Dublin Co. Co. Meath Co. Co. Hydrometric Area 08	Ballough Stream, Ballybog Hill, Delvin, Hurley, Broadmeadow, Fairyhouse Stream, Nanny	Bog of the Ring (1204)	209

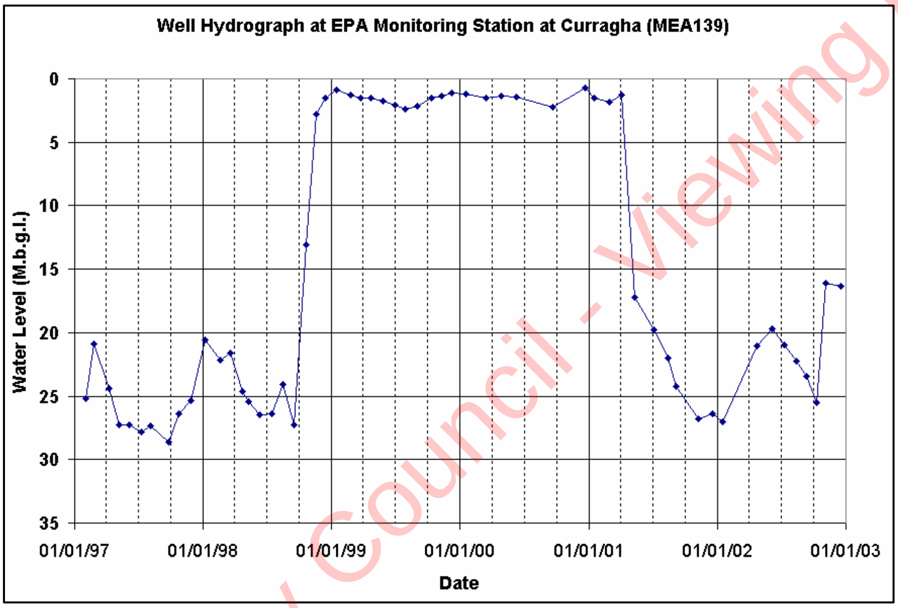
Topography		This GWB extends east from Dunshaughlin in Meath towards the coast of north Dublin. The area is mostly low lying with some areas of higher elevations along the centre of the GWB at Garristown and the Nags Head, Co. Dublin, and also along the western boundary of the GWB, which separates the Boyne catchment from Hydrometric Area 8. The higher elevations are in the order of 160 m OD. Elevation falls off from these hills along the centre of the body to the north and south and also towards the coast.
Geology and Aquifers	Aquifer type(s)	**Lm:** Locally important aquifer which is generally moderately productive Small areas (12km^2 ~ 5.7%) of **Rk**^{d}: Regionally important karstified aquifer dominated by diffuse flow
	Main aquifer lithologies	Dinantian Upper Impure Limestones (Calp Limestones). Smaller areas of Dinantian Pure Bedded Limestones. (5.7%) The limestones in this area tend to be cleaner in nature than the more typical Calp limestones and the faulting and the associated folding result in higher than usual groundwater yields.
	Key structures.	In this area the rocks are intensely folded and faulted. The severe deformation can be seen in the upper impure limestones at Loughshinny beach, where the folds are angular and partially overturned (McConnell *et al.*, 2001). The results of a drilling programme in the area of the Bog of the Ring have shown that the hydrogeology is strongly related to the structural deformation associated with the faulting in that area. Along the northern boundary of the body there is a large fault that runs east-west and separates the Lower Palaeozoic Rocks of the Balbriggan Inlier to the north from the limestones to the south. The faulting has fractured the limestones in the area, making them susceptible to karstification.
	Key properties	Transmissivity and storativity values in the aquifer appear to be better than is normal for the Calp limestone. Hydrogeological investigations (K.T. Cullen 2000) in the Bog of the Ring area, located along the northern boundary of the GWB, east of Naul, have estimated the transmissivity of the aquifer as very high, in the region of 580m^2/d. This high transmissivity may be influenced in part by presence of some gravel deposits in the area. At Curragha PWS, Co. Meath, transmissivity values of 60 - 130m^2/d have been estimated. Although not in the order of the Bog of the Ring values these are considered to be high values, indicative of a regional flow system. The specific yield of 0.002 was calculated from the pumping test data from the GSI Observation Well No.2 and indicated that the aquifer is unconfined. The pumping tests indicate that a higher permeability zone has been developed close to the surface, and the permeabilities decreases with increasing depth below ground level. During the drilling of the Curragha boreholes major inflows were found at 25 and 30m below ground. The hydrograph at Curragha (MEA139) shows the water table fluctuating at around 25m underground. The levels then rise to 2.5 below ground and fall again two years later. At the lower level the annual fluctuation of the water table is around 8m and at the higher level it is only 2m. This illustrates the increase in storativity when a larger section of the aquifer is saturated. Also the storativity of the upper layers will be higher as the degree of faulting and weathered material increases. The period of recovery, from 25m below ground to about 5m is 2 weeks. A hydrograph from the EPA station MEA159, around one kilometre from the Curragha source, shows the water table situated around 8m below ground with an annual fluctuation of less than 2m, this would suggest there is a significant degree of storativity in the aquifer. This hydrograph shows no influence of the rise in groundwater levels experienced in 1999 & 2000 suggesting the cone of depression of the aquifer is less than the 1.2km separating the boreholes. Analysis of pumping test data at the Kilmoon, Bunnan Bridge borehole indicates the aquifer is semi confined here with a transmissivity of 8.8m^2/d and a storativity value of 7 x 10^{-4}. (Cullen 1983)
	Thickness	The limestone bedrock at the Curragha PWS, located at the center of the GWB, is extensively fissured and highly broken, particularly between 32 to 35 metres b.g.l. which provides large inflows of water. Numerous calcite veins were noted, and their thickness increased with depth, with major fracturing and cavities being encountered below 30 metres. The return water was lost during the drilling from 33m below ground level, which would suggest higher permeabilities occur in this zone, due to the increased fracturing. Drilling in the Bog of the Ring area has shown inflow significant from limestone fissures at depths of 30m, 70m and 90m. Drilling in the area of Kilmoon suggests the total bedrock thickness is thinning out towards the Lower Paleozoic rocks in the area. Two individual boreholes in the area record limestone thickness of 14 and 25m. These were in both cases overlain by very thick tills (~20m) and underlain in the first instance by "red sandstones" and in the second by "green grits and slates of the underlying Lower Paleozoic basement" (Cullen 1983 & 1984). It is also of note that the wells in this area are artesian with overflows up to 200m^3/d.

Overlying Strata	Lithologies	The dominant subsoil type overlying this GWB is Limestone-derived Till which covers all but the northern and coastal area of the GWB. The thickness of the till is highly variable: in general it is thicker towards the south and thinner towards the north. In the east there are deposits of Irish Sea Till which is a low permeability boulder clay derived from ice sheets which occupied the Irish Sea during the last glaciation. In the north there are areas covered by Till derived from the Lower Paleozoic rock. There are small areas of gravel deposits and also alluvium deposits along some channels. Drilling in the Bog of the Ring area has shown the subsoil layers generally consist of till layers, in some places underlain by thick gravel deposits.
	Thickness	Available borehole information suggests that there is a highly variable thickness of subsoil overlying the aquifer. There are large areas where the subsoil is less than 5 metres thick, whereas other evidence suggests subsoil thickness of up to 40m in places.
	% area aquifer near surface	<5%
	Vulnerability	At the current time GSI groundwater vulnerability mapping has not been carried out for Co. Dublin, therefore only the portion of the GWB in Co. Meath is assessed. In general the groundwater vulnerability is Moderate. Along the western boundary and at isolated hills, where the subsoil covering thins, the vulnerability is Extreme.
Recharge	Main recharge mechanisms	There are two mechanisms for recharge in this GWB, point recharge and diffuse recharge. Diffuse recharge occurs over the majority of the area, it will be higher in the areas where subsoil is thinner and / or more permeable. Due to the Karstic nature of the aquifer it is possible to have point recharge. An example of this is at a swallow hole where a large amount of concentrated recharge occurs over a small area. In areas where the subsoil is not thick, and where the impure limestones occupy lowlands adjacent to Namurian strata, there may be karstification at the boundary between the two rock types, since the relatively corrosive runoff from the Namurian rocks would facilitate solution of the impure limestones
	Est. recharge rates	*[Information will be added at a later date]*
Discharge	Springs and large known abstractions	Curragha PWS (1200) - Fingal County Council: Bog of the Ring PWS 4000 - 5000m^3/d
	Main discharge mechanisms	Groundwater can discharge from this aquifer as baseflow to streams, as springs and as abstractions via wells, for human consumption. The main discharge areas are to the north and southeast. To the east a number of springs are recorded in the GSI Karst Database. There is an absence any major river channels here and it is likely that groundwater is forced to discharge to the surface as the system reaches capacity. The water from these springs forms streams which flow east towards the coast. There will also be groundwater discharge at the geological contact between the limestones and the less permeable Lower Paleozoic rocks to the north and with the less permeable limestones in the south.
	Hydrochemical Signature	The hydrochemical analyses of groundwater indicate a very hard water (355 - 435 mg/l ($CaCO_3$)), with a high alkalinity (310 - 325 mg/l ($CaCO_3$)). Conductivities are also high ranging from 520 - 810 μS/cm. Alkalinity values range from 200 to 350mg/l with the majority of values around 300mg/l. This groundwater can be classed as a calcium bicarbonate water.
Groundwater Flow Paths		The nature of groundwater flow in this aquifer will be determined by the degree of karstification and fracturing and the purity of the limestones. Where there is a highly karstified limestone flow will be concentrated into conduits, which may draw water very deep underground. Where the limestone is not as karstified the flow systems will be shallower and more diffuse. Although groundwater will still flow main along fractures, there will not have been the large-scale dissolution of the rocks to convert these into large conduits and groundwater flow will be less likely to take place at depths below 30m. In most of the area groundwater flow will be unconfined. Exceptions to this will be where there are thick layers of low permeability till and also where the Namuiran strata, which form the hills within the GWB, overlie the limestone.
Groundwater & surface water interactions		Bog of the Ring is a protected ecosystem, which lies to the northeast of the GWB. During pumping tests carried out in that area the water levels in the Bog were measured to asses the reaction of the Bog to local groundwater abstraction. The connection between the Bog and the groundwater system is related to the lithology of the subsoil material underlying the bog. Where the bog is underlain by till there was little or no reduction in water level caused by pumping. In areas where there are gravel deposits there was a direct connection with some monitored locations drying out completely. Groundwater and surface water are more closely linked at certain karst features such as springs and swallow holes. In this area there are a number of springs located in the eastern area of the GWB. At this point Groundwater is directly discharging into the surface water systems.

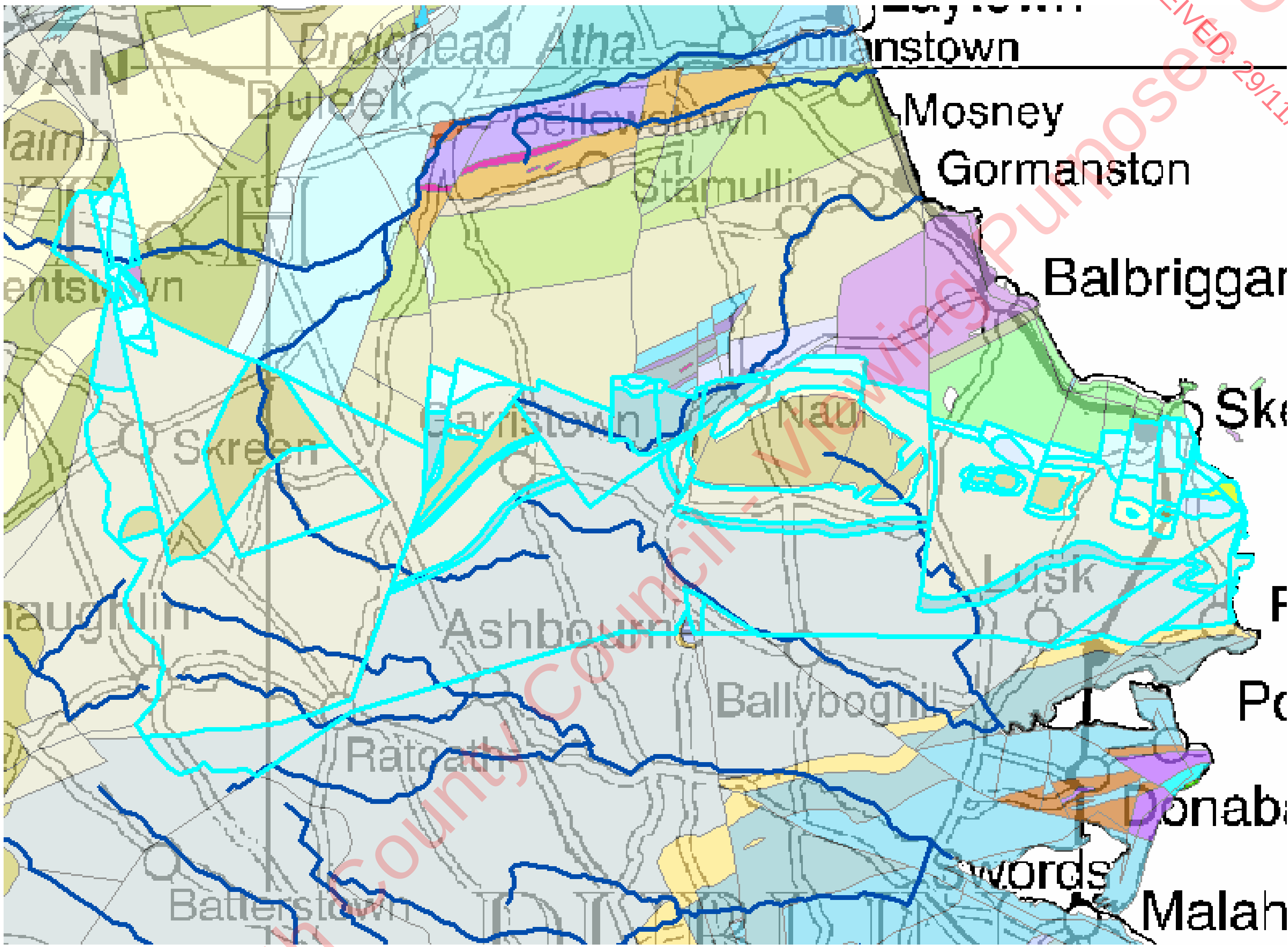
Conceptual model	This GWB is located in the North Dublin – East Meath Area. The area is low lying with higher elevations to the east and some isolated hills along the centre. The GWB is composed of moderate permeability limestone, which in some places is karstified. The extent of the groundwater body is defined to the west by the extent of Hydrometric Area 09, to the North by the contact with the Lower Paleozoic strata and to the south by the extent of the Lm Lucan formation, which in turn is a boundary of a structural region (Dumphy 2003). Very small areas of low permeability impure limestones are incorporated with this GWB, since they are isolated and do not alter significantly the flow system. Karstification of the limestone and increased transmissivity has been found in the north close to the fault, which displaces the Lower Paleozoic rocks alongside the limestone. This area has undergone structural deformation. Groundwater flow occurs along fractures and in place through solutionally enlarged karst conduits. Recharge occurs diffusely through the subsoils and via outcrops. There may be some locations where recharge is more focused i.e. within enclosed depressions, which a common in a Karst landscape. The aquifers within the GWB are generally unconfined, but may become locally confined where the subsoil is thicker and/or lower permeability and where the aquifer is overlain by Namurian Strata. Most flow in this aquifer will occur in a zone near the surface. In general, the majority of groundwater flow occurs in the upper 30 m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deep-water strikes in more isolated faults/ fractures have been encountered to 90 mbgl in the more structurally deformed area. Flow path lengths are variable, from examining the drainage density it is clear that in some instances groundwater flow paths of up to a couple of kilometres may exist, although distances of a few hundred metres area more likely. The groundwater discharges directly to the Irish Sea in the east and also to the north and south via baseflow to rivers. Analysis of water levels in the area of the Bog of the Ring has shown a direct connection between the bog and the water table in areas where the subsoil is compose of permeable material.
Attachments	
Instrumentation	Stream gauge: 08013, 08010, 08002 Borehole Hydrograph: Battersby (MEA159), Curragha (MEA139) EPA Representative Monitoring boreholes: Battersby (MEA159), Curragha (MEA026), Hayestown, Rush (DUB004)
Information Sources	Cullen KT (1983) *Report on the Drilling and Testing of Trial and Production Water Wells at Kilmoon, Co. Meath*. Report to Meath Co. Co. Cullen KT (1984) *Report on the Drilling and Testing of Water Well No. 3 at Kilmoon, Co. Meath*. Report to Meath Co. Co. K T Cullen & Co Ltd (2000) Bog of the Ring Groundwater Development Drilling and Testing Programme. Woods L, Meehan R, Wright GR (1998) *County Meath Groundwater Protection Scheme*. Report to Meath County Council. Geological Survey of Ireland. 54 p. McConnell B, Philcox M, Geraghty M (2001) *Geology of Meath: A geological description to accompany the bedrock geology 1:100,000 scale map series, Sheet 13*. Geological Survey of Ireland. 77 p. O'Connor Sutton Cronin (2003) Environmental Assessment of Proposed Loughbarn Landfill Facility.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae







Formation Name	Code	Description	Rock Unit Group	Aquifer Classification
Balrickard Formation	BC	Coarse sandstone, shale	Namurian Undifferentiated	Pl
Crufty Formation	CU	Peloidal wackestone-grainstone, shale	Dinantian Pure Bedded Limestones	Rkd
Holmpatrick Formation	HO	Grainstone-packstone, micrite	Dinantian Pure Bedded Limestones	Rkd
Lane Formation	LE	Argillaceous biocastic limestone, oolite	Dinantian Lower Impure Limestones	Ll
Loughshinny Formation	LO	Dark micrite & calcarenite, shale	Dinantian Upper Impure Limestones	Lm
Lucan Formation	LU	Dark limestone & shale (`Calp)	Dinantian Upper Impure Limestones	Lm
Lucan Formation & Mudbank Limestones	mkLU	Dark limestone & shale (`Calp)	Dinantian Upper Impure Limestones	Lm
Mudbank Limestones	mk	Massive grey micritic limestone	Dinantian Pure Unbedded Limestones	Ll
Mullaghfin Formation	MF	Pale peloidal calcarenite	Dinantian Pure Bedded Limestones	Rkd
Naul Formation	NA	Calcarenite & calcisiltite	Dinantian Upper Impure Limestones	Lm
Platin Formation	PT	Crinoidal peloidal grainstone-packstone	Dinantian Pure Bedded Limestones	Rkd
Smugglers Cave Formation	SR	Conglomerate & lithic sandstone	Dinantian Sandstones	Lm
Walshestown Formation	WL	Shale, sandstone, limestone	Namurian Undifferentiated	Pl


Droichead Atha
Duleek
Bellewstown
Stamullin
Mosney
Gormanston
Balbriggan
Naul
Garristown
Skreen
Ashbourne
Ballyboghil
Ratoath
Batterstown
Lusk
Swords
Malah

Appendix 7-C

Rating of Existing Environment Significance / Sensitivity (based on IGI, 2013 guidelines)

Importance	Criteria	Typical Example
High	Attribute has a high quality or value on an international scale	Groundwater/ Surface Water supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – e.g. NHA status. Regionally important potable water source supplying >2,500 homes Inner source protection area for regionally important water source. Drinking water supply from river. Amenity use of waterbody
	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes. Outer source protection area for locally important water source. No specific recreational use of waterbody
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes. No water supply from surface water, no abstraction designation for watercourse No amenity value of waterbody
Negligible	Attribute has negligible quality or value on a local site scale	No groundwater supply from a bedrock aquifer inn vicinity of site. Surface water not used for any specific purpose.

Appendix 7-D

Adapted from Table 3.3 Descriptions of Effects, EPA, May 2022 – Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

Impact Characteristic	Term	Description
Quality of Effects	Positive Effects	A change which improves the quality of the environment
	Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative / Adverse Effects	A change which reduces the quality of the environment
Describing the Significance of Effects	Imperceptible	An effect capable of measurement but without significant consequences
	Not significant	An effect which causes noticeable2 changes in the character of the environment but without significant consequences.
	Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects	An effect which obliterates sensitive characteristics
Describing the Extent and Context of Effects	Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect
	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Probability of Effects	Likely Effects	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Unlikely Effects	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Duration and Frequency of Effects	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day
	Temporary Effects	Effects lasting less than a year

Impact Characteristic	Term	Description
	Short-term Effects	Effects lasting one to seven years
	Medium-term Effects	Effects lasting seven to fifteen years
	Long-term Effects	Effects lasting fifteen to sixty years
	Permanent Effects	Effects lasting over sixty years
	Reversible Effects	Effects that can be undone, for example through remediation or restoration
	Frequency of Effects	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually.
Describing the Types of Effects	Indirect / Secondary Effects	Likely, significant effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	Do-Nothing Effects	The environment as it would be in the future should the subject project not be carried out.
	Worst Case Effects	The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
	Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents, (e.g. combination of SOx and NOx to produce smog).
Impact rating (IGI Guidelines 2013)	High	Results in loss of attribute and /or quality and integrity of attribute. Examples: Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually

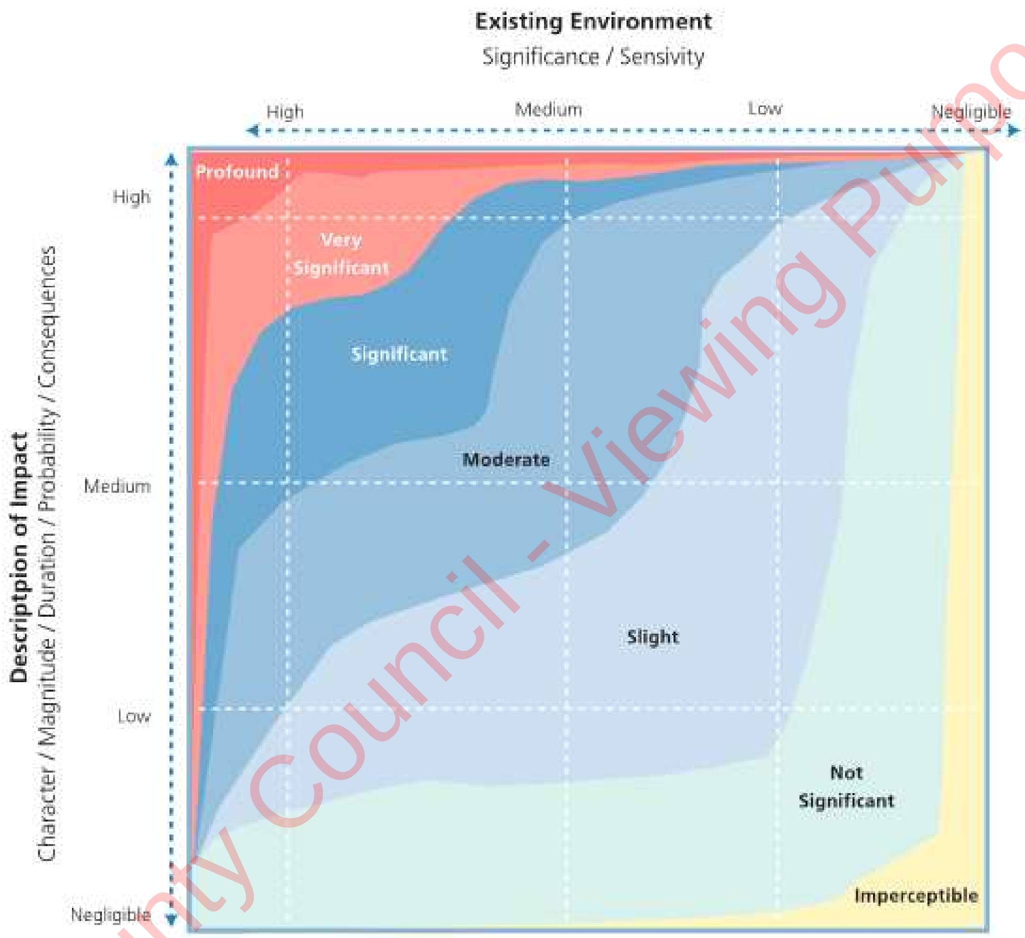
Impact Characteristic	Term	Description
	Medium	Results in impact on integrity of attribute or loss of part of attribute. Examples: Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually
	Low	Results in minor impact on integrity of attribute or loss of small part of attribute. Examples: Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
	Negligible	Results in an impact on attribute but of insufficient magnitude to aspect either use or integrity Examples: Calculated risk of serious pollution incident <0.5% annually

Appendix 7-E

Figure 3.5 Classification of the Significance of Impacts, EPA, May 2022 – Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

Determining Significance

The diagram below shows how comparison of the character of the predicted impact to the sensitivity of the receiving environment can determine the significance of the impact.



Appendix 7-F

WFD Compliance Assessment Report

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WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT PROPOSED SAND AND GRAVEL EXTRACTION AT FORD-DE-FINE, THE NAUL, CO. MEATH

FINAL REPORT

Prepared for:

KILSARAN CONCRETE UNLIMITED COMPANY

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

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Current Revision No:	P1703-0_WFD_FINAL_F0
Author:	MICHAEL GILL CONOR MCGETTIGAN NITESH DALAL
Signed:	 Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services

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FIGURES (IN TEXT)

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by SLR Consulting, on behalf of Kilsaran Concrete Unlimited Company, to complete a Water Framework Directive (WFD) Compliance Assessment in relation to the proposed sand and gravel extraction at Ford-De-Fine, the Naul, Co. Meath (the 'proposed development').

The purpose of this WFD assessment is to determine if any specific components or activities associated with the proposed development will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment will determine the water bodies with the potential to be impacted, describe the proposed mitigation measures, and determine if the project is in compliance with the objectives of the WFD.

This WFD Assessment is intended to supplement the EIAR submitted as part of the planning application for the proposed development.

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including bedrock quarries and sand and gravel pits.

This WFD assessment was prepared by Michael Gill, Conor McGettigan and Nitesh Dalal.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 22 years' environmental consultancy experience in Ireland. 22 years' environmental consultancy experience in Ireland. Michael has a degree in Civil and Environmental Engineering, a MSc in Engineering hydrology from TCD and a MSc in Applied Hydrogeology from Newcastle University. Michael has completed numerous (60+) hydrological and hydrogeological assessments relating to bedrock quarries and sand and gravel pits. Recent examples include Ardfert quarry in County Kerry and Middleton Quarry in County Cork.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 4 years' experience in environmental consultancy in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor has prepared the Land, Soils and Geology and Hydrology and Hydrogeology Chapters for numerous sand and gravel extraction EIAR projects. Conor routinely competes WFD Assessments for a wide variety of projects including wind farms, quarries and sand gravel pits.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. Nitesh is pursuing an M.Sc. in Environmental Science (2024) and holds a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

1.3 WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("**WFD**"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003).

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021.

The Water Action Plan 2024 is Ireland's 3rd River Basin Management Plan (2022 - 2027). The objectives of the Water Action Plan 2024 have been integrated into the design of the proposed development and include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

Our understanding of these objectives is that water bodies, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed.

2. WATERBODY IDENTIFICATION AND CLASSIFICATION

2.1 INTRODUCTION

This section identifies those Surface Waterbodies (SWBs) and Groundwater Bodies (GWBs) with potential to be affected by the proposed development and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

The site is located within the Nanny-Delvin surface water catchment within Hydrometric Area 8 of the Eastern River Basin District.

On a more local scale, the site is located in the Delvin_020 WFD river sub-basin. The Delvin River (Delvin_020 SWB) flows to the east along the southern boundary of the overall landholding and c/ 50m south of the site. Downstream of the site the Delvin River flows through Naul village. Meanwhile, the EPA named Fourknocks River flows to the south c. 0.3km east of the site before veering to the east. The Fourknocks River, which forms part of the Delvin_020 SWB, discharges into the Delvin River c. 1.1km east of the site. Downstream of this confluence, the Delvin River continues to the northeast, with the Delvin_040 SWB flowing through Stamullin. The Delvin_040 SWB discharges into the Northwestern Irish Sea (HA 08) coastal waterbody to the south of Gormanstown, Co. Meath.

Figure A below presents a local hydrology map of the area.

Table A presents the catchment area of each waterbody downstream of the site. The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the Delvin River. Therefore, those SWBs which are in close proximity to the site are more susceptible to water quality impacts as a result of activities associated with the proposed development. The potential for the proposed development to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Table A: Catchment Area Downstream of the Site

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Dinin[South]_SC_010 sub-catchment	
Delvin_020	~44
Delvin_030	~60
Delvin_040	~77

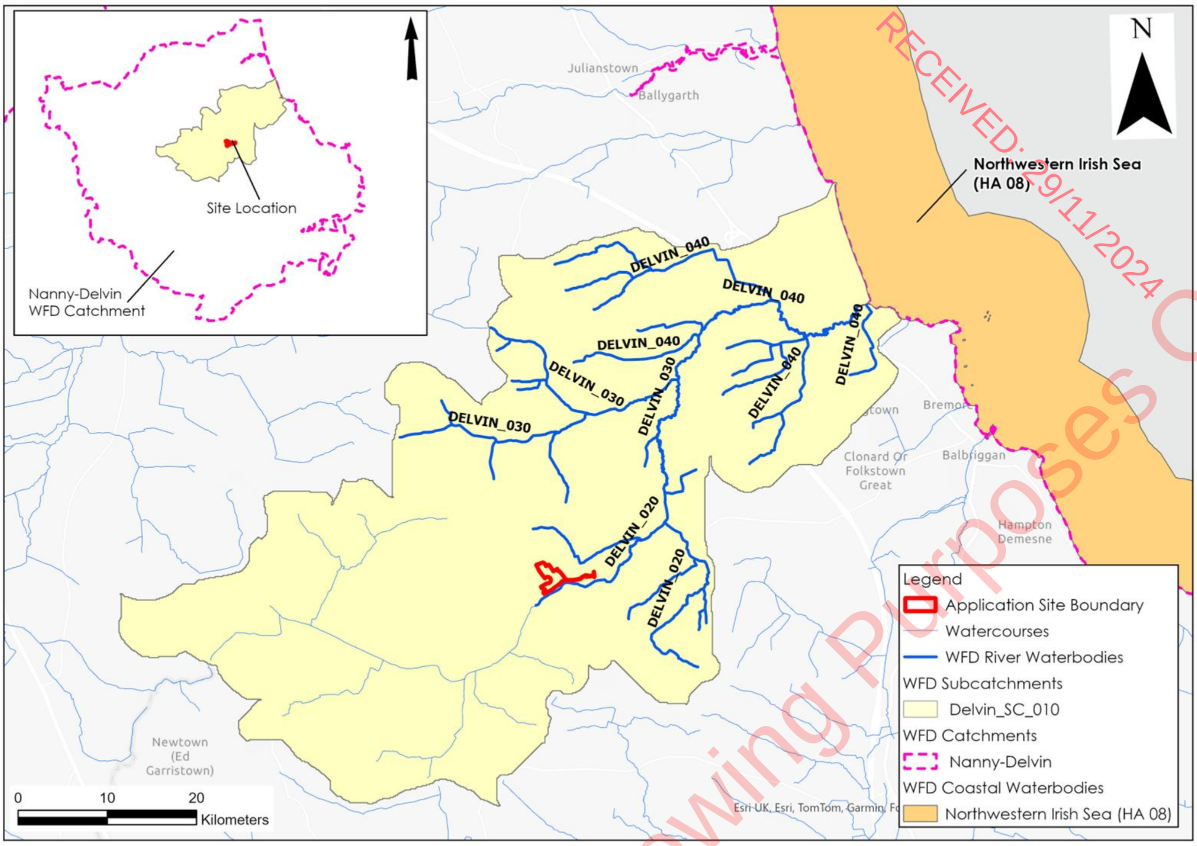

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for SWBs downstream of the site are shown in **Table B**. The overall status is based on the ecological, chemical and quantitative status of each SWB.

Local SWB status information is available from (www.catchments.ie).

As described in **Section 2.2** above, the site is drained by the Delvin_020. The Delvin_020 SWB achieved 'Moderate' status in all 3 no. WFD cycles. Further downstream, the Delvin_030 SWB also achieved 'Moderate' status in the latest WFD cycle (2016-2021). This was an improvement on the 'Poor' status which this SWB achieved in the 2nd cycle (2013-2018). Meanwhile, the Delvin_040 SWB achieved 'Poor' status in all 3 no. WFD cycles. The Northwestern Irish Sea coastal waterbody achieved 'Good' status in the latest WFD cycle. This was a reduction from the 'High' status which was achieved in the 2nd cycle.

All SWBs in the vicinity and downstream of the site have been deemed to be 'at risk' of failing to meet their respective WFD objectives.

The 3rd Cycle Nanny Delvin Catchment Report (EPA, 2024) states that agriculture is the top significant pressure in this catchment. Agriculture is listed as a significant pressure on all section of the Delvin River downstream of the site (Delvin_020, _030 and _040 SWBs). In the vicinity of the site, extractive industry and hydromorphology are also listed as significant pressures on the Delvin_020 SWB. Further downstream, domestic wastewater and industrial pressures impact the Delvin_030 SWB whilst urban wastewater effects the Delvin_040 SWB. Meanwhile, the Northwestern Irish Sea coastal waterbody is deemed to be under significant pressure from anthropogenic activities.

The SWB status for the 2016-2021 WFD cycle are shown on **Table B.**

Table B: Summary WFD Information for Surface Water Bodies

SWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	Risk Status 3rd Cycle	Pressures
	Nanny-Delvin WFD Catchment				
Delvin_020	Moderate	Moderate	Moderate	At Risk	Agriculture, Extractive Industry and Hydromorphology Pressures
Delvin_030	Unassigned	Poor	Moderate	At Risk	Agriculture, Domestic Waste Water and Industry pressures
Delvin_040	Poor	Poor	Poor	At Risk	Agriculture and Urban wastewater pressure
Northwestern Irish Sea (HA 08)	Good	High	Good	At Risk	Anthropogenic

2.4 GROUNDWATER BODY IDENTIFICATION

According to GSI (www.gsi.ie), the northern area of the site is underlain by Ordovician mudstones and siltstones with andesite sheets occurring throughout from the Clashford House Formation. The GSI classify the bedrock underlying the northern area of the site as a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones. Meanwhile, the southern area of the site is underlain by the Carboniferous calcarenite with minor chert and occasional thin shales from the Naul Formation. The GSI classify the Naul Formation as a Locally Important Aquifer – Bedrock which is Generally Moderately Productive

In terms of GWBs, the northern area of the site is underlain by the Duleek GWB (IE_EA_G_012) and the southern area is underlain by Lusk-Bog of the Ring GWB (IE_EA_G_014).

The GWB status for the 2016-2021 WFD cycle are shown on **Figure B.**

2.5 GROUNDWATER BODY CLASSIFICATION

Local GWB status information is available from (www.catchments.ie). GWBs are assigned an overall status based on both their chemical and quantitative status.

The Duleek (IE_EA_G_012) and Lusk-Bog of the ring GWBs (IE_EA_G_014) have been assigned 'Good' status in all 3 no. WFD cycles. The Duleek GWB is 'not at risk' while the Lusk-Bog of the Ring GWB is 'at risk' of failing to achieve their WFD objectives. No significant pressures have been identified to be impacting the Duleek GWB. Meanwhile, agriculture, anthropogenic and domestic wastewater have been listed as significant pressures impacting the Lusk-Bog of the Ring GWB.

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	Risk Status 3rd Cycle	Pressures
Duleek	Good	Good	Good	Not at risk	None
Lusk-Bog of the Ring	Good	Good	Good	At Risk	Agriculture, Anthropogenic and Domestic Waste Water

2.6 PROTECTED AREA IDENTIFICATION

The WFD requires that activities are also in compliance with other relevant legislation, as considered below. Nature conservation designations, bathing waters, nutrient Sensitive areas (NSA), shellfish areas and drinking water protected area's (DWPA) are looked at as part of the assessment.

2.6.1 Nature Conservation Designations

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

Whilst the site is not mapped with any designated site or protected area there are several designated sites within 10km of the site. The potential for hydrological and hydrogeological connectivity to these designated sites is discussed below:

- The Bog of the Ring pNHA (Site Code: 001204) is located ~3.5km to the east of site. There are no surface water connections from the site to this pNHA. The Delvin River acts as a hydrological barrier between the site and the pNHA. Therefore, there is no potential for hydrological or hydrogeological connectivity.
- Cromwell's Bush Fen pNHA (Site Code: 001576) is located ~3.5km to the northwest of the site. There are no surface water connections between the site and this pNHA. Groundwater at the site will flow to the south towards the Delvin River. Therefore, there is no potential for hydrological or hydrogeological connectivity.
- Knock Lake pNHA (Site Code: 001203) is located ~5.9km to the east of the site. There are no surface water connections between the site and this pNHA. Knock Lake pNHA is located in a separate GWB to the site and the Delvin River acts as a hydrological barrier. Therefore, there is no potential for hydrological or hydrogeological connectivity.
- The River Nanny Estuary and Shore SPA (Site Code: 004158) is located ~8.2km to the northeast of the site. There are no surface water connections between the site and this SPA. The Delvin River discharges into the coastal waterbody to the south of this SPA.
- Laytown Dunes Nanny Estuary pNHA (Site Code: 000554) is located ~8.2km to the northeast of the site. There are no surface water connections between the site and this SPA with the Delvin and Stadalt River acting as hydrological barriers. The Delvin River discharges into the coastal waterbody to the south of this SPA. Therefore, there is no potential for hydrological or hydrogeological connectivity.
- The North-West Irish Sea SPA (Site code: 004236) is located ~7.2km to the east of the site. Hydrological connections exist between the site and the North-West Irish SPA via the Delvin River. The total length of the hydrological flowpath between the site and this SPA is ~11.8km. Despite the connection between the site and the SPA, there is limited potential for effects given the length of the hydrological flowpath and the large volume of water with the coastal waterbody (i.e. Northwestern Irish Sea) within which the SPA is located.

2.6.2 Bathing Waters

Bathing waters are those designated under the Bathing Water Directive (76/160/EEC) or the later revised Bathing Water Directive (2006/7/EC).

There are no bathing waters in or adjacent to the site. The nearest bathing water is Balbriggan, Front Strand Beach (IEEABWC020_0000_0600) which is located ~8.3km to the east of the site. These bathing waters are associated with the Northwestern Irish Sea coastal waterbody.

2.6.3 Nutrient Sensitive Areas

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

There are no NSAs identified in the vicinity or downstream of the site. The nearest NSA is the Boyne Estuary (IE_EA_010_0100) located ~14km to the north of the site. There are no hydrological connections between the site and this NSA.

2.6.4 Shellfish Areas

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

The nearest designated shellfish area is Balbriggan\Skerries (IE_EA_020_0000) which is located ~9.5km south from the site. These designated shellfish waters are associated with the Northwestern Irish Sea coastal waterbody.

2.6.5 Drinking Water Protected Areas

There are no surface drinking water abstractions along the Delvin River in the vicinity or downstream of the site.

Meanwhile, all GWBs underlying the site are listed as Drinking Water Protected Areas (DWPAs). These DWPAs will be assessed in the Compliance Assessment in combination with the overall status of the underlying GWBs.

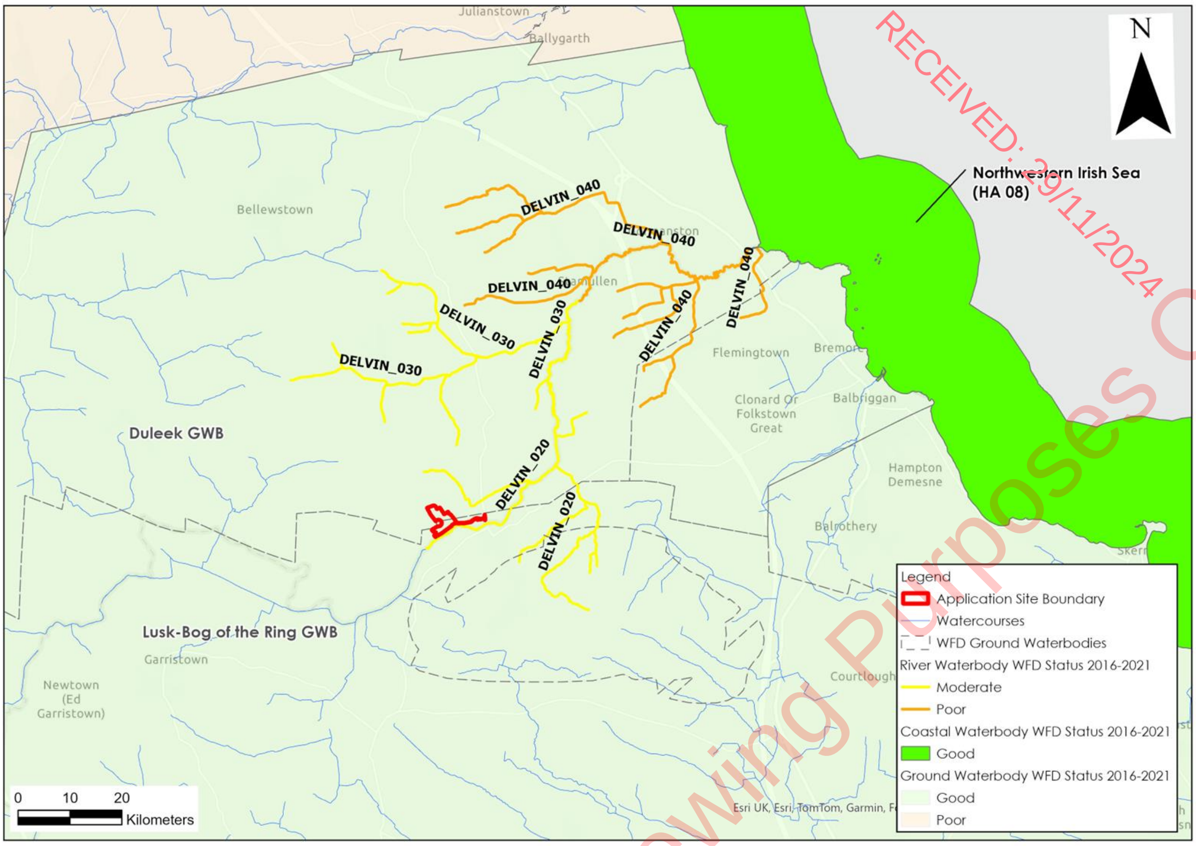

Figure B: WFD Groundwater and Surface Waterbody Status (2016-2021)

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 4 no. SWBs located in the vicinity and downstream of the site including 3 no. river waterbodies and 1 no. coastal waterbody. In addition, 2 no. GWBs underlie the site.

3.1 SURFACE WATER BODIES

The SWBs in the immediate vicinity and downstream of the site are shown in **Figure A** and described in **Section 2.2** above.

With consideration for the construction, operational and decommissioning phases of the proposed development, it is considered that the Delvin_020 and the Delvin_030 SWBs are carried through into the WFD Compliance Assessment. The Delvin_020 SWB has been included for further assessment due to the location of the site within this river sub-basin. The site drains directly to this SWB. Furthermore, the Delvin_030 SWB has been included due to its location directly downstream of the Delvin_020 SWB. The proposed development works must not in any way result in a deterioration in the status of these SWBs and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

Meanwhile, the Delvin_040 SWB has been screened out of the WFD Compliance Assessment due to its distant location from the site and the increasing volumes of water within this SWB. The increase in flow volumes in associated with the increase in the upstream catchment area of the Delvin River as detailed in

Table A. The proposed development has no potential to impact the status of this SWB.

The Northwestern Irish Sea (HA 08) coastal water body has been screened out of the WFD Compliance Assessment due to its distant location from the site, the large volumes of water within this SWB and the saline nature of these waters. The proposed development has no potential to impact the status of this SWB.

3.2 GROUNDWATER BODIES

The Duleek GWB and Lusk-Bog of the Ring GWBs are included in the WFD Compliance Assessment due to their location directly underlying the site. The proposed development works must not in any way result in a deterioration in the status of these GWBs and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

3.3 PROTECTED AREAS

There is only 1 no. designated located downstream of the site via the Delvin River. This is the North-West Irish Sea SPA and the length of the hydrological flowpath between the site and the SPA is ~11.8km. However, this SPA has not been included in the WFD Compliance Assessment due to its distant location from the site, the large volumes of water within this coastal waterbody and the saline nature of these waters. The proposed development has no potential to impact on the status of this SPA.

Several other designated sites are located within 10km of the site. However, no hydrological connections between the site and these designated sites and protected areas. Furthermore, groundwater at the site will flow to the south and will discharge into the Delvin River. Therefore, no hydrogeological connections exist between the site and any distant protected areas or designated sites.

3.4 WFD SCREENING SUMMARY

A summary of WFD Screening discussed above is shown in **Table D**.

Table D: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	Nanny-Delvin WFD Catchment			
	River	Delvin_020	**Yes**	The site is mapped within the Delvin_020 WFD river sub-basin. An assessment is required to consider the potential impacts of the proposed development on this SWB.
	River	Delvin_030	**Yes**	The Delvin_030 SWB is located immediately downstream of the Delvin_020 SWB and in close proximity to the site. An assessment is required to consider the potential impacts of the proposed development on this SWB.
	River	Delvin_040	No	The Delvin_040 SWB is located ~6km downstream of the site. The distant location and the increased flow volumes in this SWB, associated with the increased catchment area of the Delvin River, significantly reduce the potential for effects associated with the proposed development. The proposed development has no potential to affect the status of this SWB.
	Coastal	Northwestern Irish Sea (HA 08)	No	The Northwestern Irish Sea (HA 08) SWB has been screened out of the WFD Compliance Assessment due to its distant location from the site, the large volume of water within this SWB and the saline nature of these waters. The proposed development has no potential to affect the status of this SWB.
Groundwater Bodies				
Groundwater Body	Groundwater	Duleek	**Yes**	The northern section of the site is mapped to overlie the Duleek GWB. An assessment is required to consider the potential impacts of the proposed development on this GWB.
	Groundwater	Lusk-Bog of the Ring	**Yes**	The southern section of the site is mapped to overlie the Lusk-Bog of the Ring GWB. An assessment is required to consider the potential impacts of the proposed development on this GWB.
Protected Areas				
Protected Areas	Nature Conservation Designations	Cromwell's Bush Fen pNHA	No	The Cromwell's Bush Fen pNHA has been screened out due to its distant location from the site (~3.5km). There are no surface water connections between the site and this pNHA. Furthermore, groundwater at the site will flow to the south and discharge into the Delvin River. Therefore, there are no hydrogeological connections. The proposed development has no potential to affect the status of this pNHA.
		Bog Of The Ring pNHA	No	The Bog Of The Ring pNHA has been screened out due to its distant location from the site (~3.5km). There are no surface water connections between the site and this pNHA. Furthermore, groundwater at the site will flow to the south and discharge into the Delvin River. Therefore, there are no hydrogeological connections. The proposed development has no potential to affect the status of this pNHA.
		Knock Lake pNHA	No	The Knock Lake pNHA has been screened out due to its distant location from the site (~5.9km). There are no surface water connections between the site and this pNHA. Furthermore, groundwater at the site will flow to the south and discharge into the Delvin River. Therefore, there are no hydrogeological connections. The proposed development has no potential to affect the status of this pNHA.

		Rover Nanny Estuary and Shore SPA	No	The River Nanny Estuary and Shore SPA has been screened out due to its distant location from the site (~8.2km). There are no surface water connections between the site and this SPA. Furthermore, groundwater at the site will flow to the south and discharge into the Delvin River. Therefore, there are no hydrogeological connections. The proposed development has no potential to affect the status of this SPA.
		Laytown Dunes Nanny Estuary pNHA	No	The Laytown Dunes Nanny Estuary pNHA has been screened out due to its distant location from the site (~8.2km). There are no surface water connections between the site and this pNHA. Furthermore, groundwater at the site will flow to the south and discharge into the Delvin River. Therefore, there are no hydrogeological connections. The proposed development has no potential to affect the status of this pNHA.
		North-West Irish Sea SPA	No	The North-West Irish Sea SPA has been screened out it is located at distant location from the site (hydrological flowpath length of 11.8km), the large volumes of water within this SWB and the saline nature of these waters. The proposed development has no potential to affect the status of this SPA.
	Bathing Waters	Balbriggan, Front Strand Beach	No	Balbriggan, Front Strand Beach designated bathing waters have been screened out due to its distant location from the site (~8.3km) and the large volume of water within this SWB. The proposed development has no potential to impact on this protected area.
	Nutrient Sensitive Areas	Boyne Estuary	No	The Boyne Estuary NSA have been screened out due to the lack of any hydrological or hydrogeological connection with the site. The proposed development has no potential to affect the status of this NSA.
	Shellfish Area	Balbriggan\Skerries	No	Balbriggan\Skerries designated shellfish area has been screened out due to its distant location from the site (~9.5km) and the large volume of water within this SWB. The proposed development has no potential to impact on this protected area.
	DWPA	GWBs	**Yes**	Both GWBs which underlie the site are listed as DWPAs. The potential effects on these DWPAs will be assessed in the same sections as the potential effects on the underlying GWBs.

4. WFD COMPLIANCE ASSESSMENT

4.1 DEVELOPMENT PROPOSALS

The proposed development is detailed in full in Chapter 2 of this EIAR.

The proposed development being applied for under this planning application comprises of:

- Extraction and processing on site, to include washing (with associated closed recycled washing plant and lagoon system), screening and crushing plant; storage; stockpiling and haulage of sand and gravel to service the existing readymix concrete plant operated by Kilsaran on the eastern side of the R108 regional road and permitted under P. Ref. 80/572 and 22/153 (ABP-314881-22);
- The total extraction proposal extends to an area of c. 6.2 hectares and will be worked (extracted and restored) on a phased basis for a period of 11 years plus 1 year to complete final restoration works (total duration of 12 years);
- Phased stripping and storage of topsoil and overburden materials for reuse in the restoration works. Restoration of the site will be to a beneficial agricultural after-use;
- Access to the site will be through the existing agricultural enterprise site entrance onto the R108 regional road with upgrade of same to consist of setting-back of the existing boundary wall to the north of the site access, and provision for the upgrade of the existing internal access track and section of a new access track which will include a new weighbridge; and
- All associated site ancillary works within an overall application area of c. 14.9 hectares.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

The construction phase for the purpose of the proposed development is taken to include the upgrade of the existing agricultural entrance on the western side of the R108. In addition, a dedicated weighbridge will be installed along the internal access track.

4.2.1.1 Potential Surface Water Quality Effects

Construction phase activities including the upgrade of the existing agricultural entrance will require earthworks and the excavation of soil and subsoils. This could potentially result the entrainment of suspended solids in site runoff.

Hydrocarbons will also be used during the construction phase. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to surface waters at all construction sites. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Construction phase activities can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity and contamination which in turn could affect the water quality and fish stocks of downstream watercourses.

However, due to the lack of any watercourses in the immediate vicinity of the agricultural entrance, the high rates of local groundwater recharge, the small-scale of the proposed works and the short duration of the construction phase, there is only very limited potential for surface water quality effects.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the proposed development in the unmitigated scenario are outlined in **Table E.**

Table E: Potential Surface Water Quality Effects During Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Delvin_020	IE_EA_08D010250	Moderate	Moderate
Delvin_030	IE_EA_08D010300	Moderate	Moderate

4.2.1.2 Potential Groundwater Quality Effects

The site is underlain by the Duleek and the Lusk-Bog the Ring GWBs.

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a major pollution risk to groundwater. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk.

These sources of contamination have the potential to impact on groundwater quality in the underlying GWBs. However, the potential for effects is limited due to the scale of the proposed works and the short duration of the construction phase and the size of the underlying GWBs (Duleek GWB covers an area of 114km^2 while the Lusk-Bog of the Ring GWB covers an area of 209km^2).

A summary of potential status change to the Duleek and the Lusk-Bog of the Ring GWBs, arising from potential groundwater quality impacts during the construction phase of the proposed development in the unmitigated scenario are outlined in **Table F**.

Table F: Potential Groundwater Quality Effects During Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Duleek	IE_EA_G_012	Good	Good
Lusk-Bog of the Ring	IE_EA_G_014	Good	Good

4.2.2 Operational Phase (Unmitigated)

The operational phase of the proposed development comprises the extraction of the sand and gravel reserves which will be completed in line with best international practice. The extraction area covers c. 6.2ha and will be worked (extracted and restored) on a phased basis (Phases 1 to 3). Soil and topsoil will be stripped and stored for reuse in the restoration. All material extracted onsite will be processed on site and hauled to service the existing readymix concrete plant operated by Kilsaran on the eastern side of the R108.

Restoration of the extracted areas will be carried out at the earliest opportunity in tandem with the extraction operations with the final restoration proposals being completed once extraction operations have ceased. It is proposed to restore the extraction area to an agricultural after use using the topsoil which was temporarily stored during the extraction operations. All structures, plant, equipment and stockpiles will be removed from the site. If required land/filed drainage measures will be put in place following restoration. No significant impacts on the hydrological and hydrogeological environment are expected during the restoration works.

4.2.2.1 Potential Surface Water Quality Effects

During the operational phase, there will be a requirement to strip and store soil and topsoil at the site. In addition, sand and gravel subsoils will be removed from the 3 no. phased extraction areas. During extraction, overburden removal will be an intermittent process and will be done so as the pit faces are progressed to the north in Phase 1, to the south in Phase 2 and to the west in Phase 3. These earthworks could have the potential to result in sediment entrainment in surface water runoff from the site. The greatest potential effects arise from runoff from the spoil storage areas.

The excavation works will be completed using machinery powered by diesel engines and operated using hydraulics. Unless managed carefully such plant and machinery have the potential to leak hydraulic oils or cause fuel leaks during refuelling operations which could affect local surface water quality.

However, the site is characterised by high rates of groundwater recharge and low rates of surface water runoff. Furthermore, during the operational phase there will be no discharge to surface waters and all water within the extraction areas will be discharged to ground (as per the greenfield conditions). The only potential pathway between the extraction areas and the Delvin River is via groundwater recharge, the lateral migration of groundwater and discharge to the river as baseflow. The natural sand and gravel subsoils at the site are excellent natural filters and will remove all suspended sediment from the groundwater prior to it reaching the Delvin River.

However, in an unmitigated scenario, there may be some surface water runoff from the site during storm events. This storm runoff could continue overland and discharge into the Delvin River without recharging to ground. Based on the existing baseline environment, runoff volumes during storm events will be small.

A summary of potential status change to SWBs arising from increased runoff during the operational phase of the proposed development in the unmitigated scenario are outlined in **Table G**.

Table G: Potential Surface Water Quality Effects During Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Delvin_020	IE_EA_08D010250	Moderate	Poor
Delvin_030	IE_EA_08D010300	Moderate	Moderate

4.2.2.2 Potential Surface Water Quantity Effects

During the operational phase, there will be no direct discharge to surface waters. All rainfall falling within the extraction areas will be allowed to recharge to ground as per the existing greenfield conditions. The removal of topsoil and less permeable subsoils may result in a slight increase in the groundwater recharge rates and a very small increase in river baseflow contribution from groundwater.

Paragraph 7.197 and 7.198 of the EIAR present a conservative analysis whereby it is assumed that 100% of the rainfall falling in the extraction areas will recharge to ground during the operational phase. Such an increase in groundwater recharge rates would represent a 25% increase in recharge from the baseline scenario where it is estimated that 80% of precipitation recharges to ground. The baseflow volumes form the proposed extraction areas have been compared to flood flow volumes in the Delvin River. Even in a worst case scenario whereby all of the subsoils at the site consist of clean and permeable sand and gravels, the baseflow to the Delvin River represents less than 1% of the Q_1 flow volume in the Delvin River. Note that flood flow volumes in the Delvin River associated with a 1 in 10-year, 1 in 100-year or 1 in 1,000-year flood events, will be significantly greater than the Q1 flow.

Therefore, given the baseline hydrogeological regime (characterised by high rates of groundwater recharge and low rates of surface water runoff), the lack of any proposed surface water discharge, the small, proposed extraction area (6.2ha) in comparison with the total catchment area of the Delvin River, the proposed development will not significantly alter runoff or recharge rates and there will be no discernible impact on the surface water quantity in the Deliver River.

A summary of potential status change to SWBs arising from surface water quality impacts during the operation phase of the proposed development in the unmitigated scenario are outlined in **Table H**.

Table H: Potential Surface Water Quantity Effects During Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Delvin_020	IE_EA_08D010250	Moderate	Moderate
Delvin_030	IE_EA_08D010300	Moderate	Moderate

4.2.2.3 Potential Groundwater Quality Effects

The removal of sand and gravels will increase the vulnerability of the underlying bedrock GWBs, making them more susceptible to potential qualitative effects. It should be noted that groundwater vulnerability is currently rated as high based on the site hydrogeological conditions (thick permeable sand and gravel subsoils).

All sand and gravel will be excavated by the extraction by load, haul, dump method, this will increase the dust and suspended solids and could increase suspended solids in the groundwater in the sand and gravel which could in turn impact water quality in the underlying GWBs. However, sand and gravel is an excellent natural filter and will remove all suspended sediment in groundwater.

The occurrence of accidental spills and leaks of hydrocarbons from plant and machinery could have the potential to impact on groundwater quality in the underlying GWBs.

However, given the scale of the GWBs (Lusk – Bog of the Ring GWB covers an area of 209km^2 while the Duleek GWB covers an area of ~114km^2), in comparison with the proposed extraction areas (0.062km^2) there is little potential for the proposed development to alter the overall qualitative status of the entire GWBs.

A summary of potential status change to the Duleek and the Lusk-Bog of the Ring GWBs, arising from groundwater quality impacts during the operation phase of the proposed development in the unmitigated scenario are outlined in **Table I**.

Table I: Potential Groundwater Quality Effects During Operational Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Duleek	IE_EA_G_012	Good	Good
Lusk-Bog of the Ring	IE_EA_G_014	Good	Good

4.2.2.4 Potential Groundwater Quantity Effects

The final floor levels of the phased extraction areas range from c. 77 t0 101mOD for Phase 1, c. 65 to 85mOD for Phase 2 and c. 67 to 80mOD for Phase 3. The floor of the extraction areas will follow existing topography and will be slopes to the south within each of the phased extraction areas. The monitoring of groundwater levels within the site have revealed that the water levels are highest in the north of the site and fall to the south towards the Delvin River. The maximum recorded water levels at the site range from 65.5mOD in the southeast at BH1 (in the Phase 2 extraction area) to 96.5mOD in the northwest at BH3 (in the Phase 1 extraction area).

Extraction will be predominantly above the local groundwater table however some extraction is proposed below the maximum recorded groundwater levels. No active dewatering of groundwater is proposed (no pumping) and due to the permeable nature of the subsoils and the sloping topography, it is considered that the sands and gravels will continue to drain naturally to the south. Any groundwater drainage will be temporary. The final floor levels of the sand and gravel pit have been designed to consider the maximum winter water levels and reduce the works below the water table. For example the proposed floor level in Phase 1 extraction area is shallowest in the north due to the higher groundwater levels in this area of the site.

The removal of the overburden may also result in a slight increase in recharge to the sand and gravel aquifer. During Phase 3 the main existing drainage ditch within the site will direct water onto the floor in the Phase 3 extraction area. This may result in a reduction in surface water runoff and a slight increase in groundwater recharge during storm events. Any change is likely to be minimal as these drainage ditches are typically dry. Greenfield runoff rates are very low and most rainfall falling at the site currently recharges to ground.

A summary of potential status change to the Duleek and the Lusk-Bog of the Ring GWBs, arising from groundwater quality impacts during the operation phase of the proposed development in the unmitigated scenario are outlined in **Table J**.

Table J: Potential Groundwater Quantity Effects During Operational Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Duleek	IE_EA_G_012	Good	Good
Lusk-Bog of the Ring	IE_EA_G_014	Good	Good

4.3 MITIGATION MEASURES

In order to mitigate against the potential negative effects on surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the construction and operational phases of the proposed development. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures for Hydrocarbons

The following measures will be implemented at the site to prevent leaks and/or spills during the construction phase, these are mitigation by prevention:

- No fuel will be stored on-site;
- All mobile machinery refuelling will be carried out using a mobile bowser;

- Drip trays will be used for all re-fuelling activities;
- All machinery maintenance and repairs will take off-site at the existing concrete batching plant facility;
- All plant will be regularly maintained and inspected daily for leaks of fuels, lubricating oil or other contaminating liquids;
- All petroleum-based products (lubricating oils, waste oils, etc.) will be stored on drip trays under cover to prevent pollution due to accidental leakages;
- Waste oil and grease containers will be stored under cover in storage container. Waste containers will be collected and disposed of by a suitably licenced contractor;
- An emergency spill response kit (with containment booms, absorbent materials and drip tray) will be available on-site to contain/ stop the migration of any accidental spillages, should they occur;
- Plant operators will be briefed during 'toolbox' talks and site induction on where the spill kit is kept and how and when it is deployed;
- Traffic management system at the site will reduce conflicts between vehicles, and the potential risk of collisions and associated fuel spills or oil leaks; and,
- Site speed limits will be implemented across the site to further reduce the likelihood and significance of collisions and hence the possibility of a fuel leak from such a collision.

4.3.2 Operational Phase

4.3.2.1 Mitigation Measures for Groundwater Vulnerability

Soil stripping and restoration of worked out areas will be carried out on a progressive basis to reduce the vulnerability of the bedrock aquifer to possible contamination. The main mitigation with respect to groundwater quality protection during the operational phase will be the employment of best practice measures with respect to oil usage and refuelling of plant and machinery.

Post extraction a restoration plan will be implemented which will involve the previously stripped soil being placed on the pit floor to establish grassland which will provide a level of protection to groundwater. Post restoration, the site will be returned to agriculture which will reduce the risk of illegal activities such as fly-tipping.

4.3.2.2 Mitigation Measures to Protect Groundwater Quantity

Some excavation is proposed below the local groundwater table. However, no significant volumes of groundwater will accumulate within the extraction areas as the proposed levels have been designed to reflect the water levels recorded at the site.

Where extraction occurs below the groundwater table, water will be directed to a sump on the pit floor and will be allowed to recharge naturally back into the ground.

4.3.2.3 Mitigation Measures to Prevent Sediment Entrainment in Runoff

Mitigation measures proposed include the following:

- Overall surface water runoff from the site will be low due to the permeable nature of the soils and subsoils;
- Prior to any overburden stripping or extraction a shallow cut-off drain will be installed along the southern boundary of the site to prevent any site run-off which my potentially contain suspended solids from flowing over ground to the adjacent Delvin River. The proposed cut-off drain will run parallel to the river and will be between 40 and 50m from the river channel leaving a significant buffer zone between the drain and the river. Water within the cut-off drain will be discharged to ground;
- Soil stripping and restoration of worked out areas will be carried out on a progressive basis;

- The temporary soil / subsoil areas will be managed to minimise the risk of rain / wind erosion;
- Daily monitoring of the overburden stripping and soil storage areas will be completed by a suitably qualified person. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter will enter the downstream receiving waters;
- Overburden stripping and landscaping works will be scheduled for periods of low rainfall (summer months) to reduce run-off and potential siltation;
- Recently restored areas and temporary soil/overburden storage berms will be grass seeded as soon as possible after formation to reduce the potential of surface water erosion; and,
- Good construction practices such wheel washers and dust suppression on site roads, and regular plant maintenance will ensure minimal risk. The Construction Industry Research and Information Association (CIRIA) provide guidance on the control and management of water pollution from construction sites ('Control of Water Pollution from Construction Sites, guidance for consultants and contractors', CIRIA, 2001), which provides information on these issues. This will ensure that surface water arising during the course of overburden stripping and landscaping activities will contain minimum sediment.

4.3.2.4 Mitigation Measures for Hydrocarbons

During the operational phase the mitigation measures implemented to prevent the release of hydrocarbons will be the same as those for the construction phase detailed above in Section 4.3.1.1.

4.3.2.5 Mitigation Measures to Protect Groundwater Quality from Suspended Solids

No specific mitigation measures are required due to the excellent filtration capacity of the sand and gravel subsoils at the site.

4.3.2.6 Mitigation Measures to Protect Surface Water Quantity

No specific mitigation measures are required as the proposed development does not significantly alter the existing hydrogeological regime or the existing rates of groundwater recharge and surface water runoff.

A quantitative assessment, presented in the EIAR, has been completed for a range of flood scenarios, and for a range of subsoil permeabilities, which demonstrates that the baseflow contribution from the extraction area to the Delvin River is insignificant in comparison with the flow volumes within the river itself.

Based on the above, even in the absence of mitigation measures there will be no change in the quantitative status of downstream watercourses and there will be no increase in the downstream flood risk.

4.3.1 Post-Operational/Final Restoration Phase

Post operation, the site will return to an agricultural use, including re-instatement of hedgerow on location similar to those which will be removed to facilitate the proposed development.

The final restoration includes the removal of all plant and machinery from the site.

No significant effects are anticipated from the post-operational phase. The final restoration will have a positive effect in terms of reduced groundwater vulnerability.

4.3.2 Potential Effects with the Implementation of Mitigation

In all instances, the mitigation measures described in **Section 4.3** are sufficient to meet the WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table K** below.

Table K: Summary of WFD Status for Unmitigated and Mitigated Scenarios

Water Body Name	WFD Code	Current Status	Assessed Status - Unmitigated	Assessed Status with Mitigation Measures
Surface Water Bodies				
Delvin_020	IE_EA_08D010250	Moderate	Poor	Moderate
Delvin_030	IE_EA_08D010300	Moderate	Moderate	Moderate
Groundwater Bodies				
Duleek	IE_EA_G_012	Good	Good	Good
Lusk-Bog of the Ring	IE_EA_G_014	Good	Good	Good

5. SUMMARY AND CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the site are defined in **Section 2** above.

The proposed development does not involve any abstraction of groundwater, surface water discharges, or significant alteration of existing groundwater recharge or surface water runoff rates. Therefore, the quantitative status (i.e., the available quantity (*i.e.* volume of groundwater and surface water locally) of the downstream SWBs and underlying GWBs will remain unaltered during the construction, operational and post-operational phases of the proposed development.

Mitigation for the protection of surface and groundwater during the construction, operation and post-operational phases of the proposed development will ensure the qualitative status of the receiving waters will not be altered by the proposed development.

There will be no change in GWB or SWB status in the underlying GWBs or downstream SWBs resulting from the proposed development. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWBs are protected from any potential deterioration from chemical pollution.

As such, the proposed development will not impact upon any surface water or groundwater body as it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of good status.

As such, the Proposed Development:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in paragraph 7.21 of EIAR Chapter 7).

* * * * * * * * * * * * *

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Appendix 7-G

Original laboratory Reports

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Email: info@fitzsci.ie

A copy of this certificate is available on www.fitzsci.ie.

Customer supplied information appear in italics.

Customer	*Fergus Gallagher*	Lab Report Ref. No.	1900/2406920/01
	Kilsaran Concrete	Date of Receipt	11/06/2024
	Piercetown	*Sampled On*	*11/06/2024*
	Dunboyne	Date Testing Commenced	11/06/2024
	Co Meath	Received or Collected	Delivered by Customer
		Condition on Receipt	Acceptable
Customer PO	*HO9145*	Date of Report	25/06/2024
Customer Ref	*SW1*	*Sample Type*	*Surface Water*
Ref 2	*The Naul*		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	0.01	mg/L as N	INAB
BOD (Surface Water)	113	Electrometry	0.9	mg/L	INAB
COD (Surface Water)	107	Colorimetry	12	mg/L	INAB
Conductivity (Surface Water at 20C)	112	Electrometry	564.0	µscm -1@20C	INAB
Nitrate (Surface Water)	103	Colorimetry	2.73	mg/L as N	INAB
Nitrite (Surface Water)	118	Colorimetry	0.030	mg/L as N	INAB
pH (Surface Water)	110	Electrometry	8.12	pH Units	INAB
Phosphate (Ortho) Surface Water	117	Colorimetry	0.04	mg/L as P	INAB
Phosphorus (Total) Surface Water	166	Colorimetry	0.09	mg/L as P	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	

Signed: A Harmon

Date: 25/06/2024

Aoife Harmon - Laboratory Supervisor

Acc. : Accredited Parameters by ISO/IEC 17025:2017

ilac-MRA | INAB ISO 17025 ACCREDITED TESTING DETAILED IN SCOPE REG NO.389T

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Customer	*Fergus Gallagher* *Kilsaran Concrete* *Piercetown* *Dunboyne* *Co Meath*	Lab Report Ref. No.	1900/2406920/02
		Date of Receipt	11/06/2024
		Sampled On	*11/06/2024*
		Date Testing Commenced	11/06/2024
		Received or Collected	Delivered by Customer
		Condition on Receipt	Acceptable
Customer PO	*HO9145*	Date of Report	25/06/2024
Customer Ref	*SW2 (Naul Bridge)*	*Sample Type*	*Surface Water*
Ref 2	*The Naul*		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	0.01	mg/L as N	INAB
BOD (Surface Water)	113	Electrometry	0.8	mg/L	INAB
COD (Surface Water)	107	Colorimetry	13	mg/L	INAB
Conductivity (Surface Water at 20C)	112	Electrometry	571.0	µscm -1@20C	INAB
Nitrate (Surface Water)	103	Colorimetry	2.73	mg/L as N	INAB
Nitrite (Surface Water)	118	Colorimetry	0.023	mg/L as N	INAB
pH (Surface Water)	110	Electrometry	8.12	pH Units	INAB
Phosphate (Ortho) Surface Water	117	Colorimetry	0.03	mg/L as P	INAB
Phosphorus (Total) Surface Water	166	Colorimetry	0.05	mg/L as P	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	

Signed: A Harmon **Date: 25/06/2024**

Aoife Harmon - Laboratory Supervisor

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Customer supplied information appear in italics.

Customer	*Michael Sheehan* *Kilsaran Concrete* *Piercetown* *Dunboyne* *Co Meath*	Lab Report Ref. No.	1900/2406933/01
		Date of Receipt	20/06/2024
		Sampled On	*20/06/2024*
		Date Testing Commenced	20/06/2024
		Received or Collected	Delivered by Customer
		Condition on Receipt	Acceptable
Customer PO	*HO9145*	Date of Report	04/07/2024
Customer Ref	*SW1*	*Sample Type*	*Surface Water*
Ref 2	*The Naul*		
Ref 3	*Kilsaran*		

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	0.01	mg/L as N	INAB
BOD (Surface Water)	113	Electrometry	3.2	mg/L	INAB
COD (Surface Water)	107	Colorimetry	12	mg/L	INAB
Conductivity (Surface Water at 20C)	112	Electrometry	564.0	µscm -1@20C	INAB
Nitrate (Surface Water)	103	Colorimetry	2.92	mg/L as N	INAB
Nitrite (Surface Water)	118	Colorimetry	0.011	mg/L as N	INAB
pH (Surface Water)	110	Electrometry	8.10	pH Units	INAB
Phosphate (Ortho) Surface Water	117	Colorimetry	0.05	mg/L as P	INAB
Phosphorus (Total) Surface Water	166	Colorimetry	0.11	mg/L as P	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	

Signed: A Harmon

Date: 04/07/2024

Aoife Harmon - Laboratory Supervisor

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Customer	*Michael Sheehan* *Kilsaran Concrete* *Piercetown* *Dunboyne* *Co Meath*	Lab Report Ref. No.	1900/2406933/02
		Date of Receipt	20/06/2024
		Sampled On	*20/06/2024*
		Date Testing Commenced	20/06/2024
		Received or Collected	Delivered by Customer
		Condition on Receipt	Acceptable
Customer PO	*HO9145*	Date of Report	04/07/2024
Customer Ref	*SW2*	*Sample Type*	*Surface Water*
Ref 2	*The Naul*		
Ref 3	*Kilsaran*		

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	0.02	mg/L as N	INAB
BOD (Surface Water)	113	Electrometry	0.7	mg/L	INAB
COD (Surface Water)	107	Colorimetry	14	mg/L	INAB
Conductivity (Surface Water at 20C)	112	Electrometry	571.0	µscm -1@20C	INAB
Nitrate (Surface Water)	103	Colorimetry	2.88	mg/L as N	INAB
Nitrite (Surface Water)	118	Colorimetry	0.008	mg/L as N	INAB
pH (Surface Water)	110	Electrometry	8.15	pH Units	INAB
Phosphate (Ortho) Surface Water	117	Colorimetry	0.07	mg/L as P	INAB
Phosphorus (Total) Surface Water	166	Colorimetry	0.10	mg/L as P	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	

Signed: A Harmon

Date: 04/07/2024

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Customer	*Michael Sheehan* *Kilsaran Concrete* *Piercetown* *Dunboyne* *Co Meath*	Lab Report Ref. No.	1900/2406943/01
		Date of Receipt	25/06/2024
		Sampled On	*25/06/2024*
		Date Testing Commenced	25/06/2024
		Received or Collected	Delivered by Customer
		Condition on Receipt	Acceptable
Customer PO	*HO9145*	Date of Report	09/07/2024
Customer Ref	*SW1*	*Sample Type*	*Surface Water*
Ref 2	*The Naul*		
Ref 3	*Kilsaran*		

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	0.03	mg/L as N	INAB
BOD (Surface Water)	113	Electrometry	0.9	mg/L	INAB
COD (Surface Water)	107	Colorimetry	13	mg/L	INAB
Conductivity (Surface Water at 20C)	112	Electrometry	559.0	µscm -1@20C	INAB
Nitrate (Surface Water)	103	Colorimetry	2.34	mg/L as N	INAB
Nitrite (Surface Water)	118	Colorimetry	0.017	mg/L as N	INAB
pH (Surface Water)	110	Electrometry	7.85	pH Units	INAB
Phosphate (Ortho) Surface Water	117	Colorimetry	0.06	mg/L as P	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	

Signed: *Katherine McQuillan*   **Date: 09/07/2024**

Katherine McQuillan - Technical Manager

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Customer supplied information appear in italics.

Customer	*Michael Sheehan*	Lab Report Ref. No.	1900/2406943/02
	Kilsaran Concrete	Date of Receipt	25/06/2024
	Piercetown	*Sampled On*	*25/06/2024*
	Dunboyne	Date Testing Commenced	25/06/2024
	Co Meath	Received or Collected	Delivered by Customer
		Condition on Receipt	Acceptable
Customer PO	*HO9145*	Date of Report	09/07/2024
Customer Ref	*SW2 (Naul Bridge)*	*Sample Type*	*Surface Water*
Ref 2	*The Naul*		
Ref 3	*Kilsaran*		

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	0.03	mg/L as N	INAB
BOD (Surface Water)	113	Electrometry	0.9	mg/L	INAB
COD (Surface Water)	107	Colorimetry	6	mg/L	INAB
Conductivity (Surface Water at 20C)	112	Electrometry	569.0	µscm -1@20C	INAB
Nitrate (Surface Water)	103	Colorimetry	2.60	mg/L as N	INAB
Nitrite (Surface Water)	118	Colorimetry	0.014	mg/L as N	INAB
pH (Surface Water)	110	Electrometry	8.04	pH Units	INAB
Phosphate (Ortho) Surface Water	117	Colorimetry	0.06	mg/L as P	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	

Signed: Katherine McQuillan

Date: 09/07/2024

Katherine McQuillan - Technical Manager

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Customer supplied information appear in italics.

Customer	*Michael Sheehan*	Lab Report Ref. No.	1900/2407954/01
	Kilsaran Concrete	Date of Receipt	03/07/2024
	Piercetown	*Sampled On*	*03/07/2024*
	Dunboyne	Date Testing Commenced	03/07/2024
	Co Meath	Received or Collected	Delivered by Customer
		Condition on Receipt	Acceptable
Customer PO	*HO9145*	Date of Report	17/07/2024
Customer Ref	*SW1*	*Sample Type*	*Surface Water*
Ref 2	*The Naul*		
Ref 3	*Kilsaran*		

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	0.11	mg/L as N	INAB
BOD (Surface Water)	113	Electrometry	0.9	mg/L	INAB
COD (Surface Water)	107	Colorimetry	<5	mg/L	INAB
Conductivity (Surface Water at 20C)	112	Electrometry	556.0	µscm -1@20C	INAB
Nitrate (Surface Water)	103	Colorimetry	2.34	mg/L as N	INAB
Nitrite (Surface Water)	118	Colorimetry	0.036	mg/L as N	INAB
pH (Surface Water)	110	Electrometry	7.94	pH Units	INAB
Phosphate (Ortho) Surface Water	117	Colorimetry	0.05	mg/L as P	INAB
Phosphorus (Total) Surface Water	166	Colorimetry	0.43	mg/L as P	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	

Signed: [signature] **Date: 17/07/2024**

Aoife Harmon - Laboratory Supervisor

Acc. : Accredited Parameters by ISO/IEC 17025:2017

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Customer supplied information appear in italics.

Customer	*Michael Sheehan*	Lab Report Ref. No.	1900/2407954/02
	Kilsaran Concrete	Date of Receipt	03/07/2024
	Piercetown	*Sampled On*	*03/07/2024*
	Dunboyne	Date Testing Commenced	03/07/2024
	Co Meath	Received or Collected	Delivered by Customer
		Condition on Receipt	Acceptable
Customer PO	*HO9145*	Date of Report	17/07/2024
Customer Ref	*SW2 (Naul Bridge)*	*Sample Type*	*Surface Water*
Ref 2	*The Naul*		
Ref 3	*Kilsaran*		

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	0.22	mg/L as N	INAB
BOD (Surface Water)	113	Electrometry	1	mg/L	INAB
COD (Surface Water)	107	Colorimetry	11	mg/L	INAB
Conductivity (Surface Water at 20C)	112	Electrometry	568.0	µscm -1@20C	INAB
Nitrate (Surface Water)	103	Colorimetry	2.45	mg/L as N	INAB
Nitrite (Surface Water)	118	Colorimetry	0.022	mg/L as N	INAB
pH (Surface Water)	110	Electrometry	8.09	pH Units	INAB
Phosphate (Ortho) Surface Water	117	Colorimetry	0.05	mg/L as P	INAB
Phosphorus (Total) Surface Water	166	Colorimetry	0.11	mg/L as P	INAB
Solids (Total Suspended)	106	Gravimetry	<5	mg/L	

Signed: A Harmon **Date: 17/07/2024**

Aoife Harmon - Laboratory Supervisor

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Appendix 7-H

Flood Risk Assessment

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PROPOSED SAND AND GRAVEL EXTRACTION
FORD-DE-FINE, THE NAUL, CO. MEATH

FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

KILSARAN CONCRETE UNLIMITED COMPANY

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

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Disclaimer:
This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site specific and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by Kilsaran Concrete Unlimited Company to undertake a Flood Risk Assessment (FRA) for the proposed development.

This FRA is written to accompany Chapter 7 of the Environmental Impact Assessment Report (EIAR) for the proposed development. The proposed development is described in full in Chapter 2 of the EIAR. For the purposes of this FRA, and consistent with the EIAR, the various components are described and assessed using the following references: 'proposed development' and the 'site'.

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009).

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is a Civil/Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. In addition, he has substantial experience in geological characterisation, peatland morphology, and surface water drainage design and SUDs design and surface water/groundwater interactions. Michael has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, Derrinlough WF and over 100 other wind farm related projects across the country.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 4 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the hydrology and hydrogeology chapters of environmental impact assessment reports for wind farm developments. Conor has also prepared several flood risk assessments and Water Framework Directive compliance assessments for various renewable energy developments in Ireland.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. Nitesh is pursuing an M.Sc. in Environmental Science (2024) and holds a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the site setting and details of the proposed development;
- Section 3 outlines the hydrological and geological characteristics of the Delvin River Catchment in the vicinity of the site;
- Section 4 presents our initial flood risk identification undertaken for the proposed development based on desk studies and walkover surveys and a resultant Justification Test based on our findings;
- Section 5 details the drainage proposals associated with the proposed development and determines a flood impact assessment for the proposed development; and,
- Section 6 presents the FRA report conclusions.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the site along with a description of the proposed development.

2.2 SITE LOCATION AND TOPOGRAPHY

The site is located in Co. Meath northwest of The Naul Village, Co. Dublin. The site slopes gently upward in a northerly direction from c. 70mOD to c. 110mOD. The area to the north of the site continues to rise up to a maximum elevation of c. 155mOD. To the south, the land continues to fall towards the Delvin River before rising again to high point of c. 140mOD south of the R122 road and the Naul village. East and west of the site are at similar elevations to the site. Meanwhile, a small valley separates the proposed extraction areas from the R108 to the east.

The Delvin River flows along the southern boundary of the overall landholding and c. 50m from the site. This river flows in an easterly direction towards the Irish Sea. The Fourknocks River flows c. 0.3km east of the site in a southerly direction initially and then flows to the east before it discharges into the Delvin River.

Land-use at the site comprises of agricultural land. The surrounding land is mainly agricultural farmland and dispersed residential housing. Naul town is less than 1km to the south-east of the site. There is a former sand and gravel pit directly to the southwest of the application area.

A site location map is shown as **Figure A**.

2.3 PROPOSED DEVELOPMENT DETAILS

The proposed development is detailed in full in Chapter 2 of the EIAR.

The proposed and amended development being applied for under this planning application comprises of:

- Extraction and processing on site, to include washing (with associated closed recycled washing plant and lagoon system), screening and crushing plant; storage; stockpiling and haulage of sand and gravel to service the existing readymix concrete plant operated by Kilsaran on the eastern side of the R108 regional road and permitted under P. Ref. 80/572 and 22/153 (ABP-314881-22);
- The total extraction proposal extends to an area of c. 6.2 hectares and will be worked (extracted and restored) on a phased basis for a period of 11 years plus 1 year to complete final restoration works (total duration of 12 years);
- Phased stripping and storage of topsoil and overburden materials for reuse in the restoration works. Restoration of the site will be to a beneficial agricultural after-use;
- Access to the site will be through the existing agricultural enterprise site entrance onto the R108 regional road with upgrade of same to consist of setting-back of the existing boundary wall to the north of the site access, and provision for the upgrade of the existing internal access track and section of a new access track which will include a new weighbridge; and
- All associated site ancillary works within an overall application area of c. 14.9 hectares.
- The existing permitted concrete batching facility (P. Ref. 80/572 & P. Ref. 22/153 (ABP-314881-22) to the east of the R108 regional road does not fall within the red line planning application boundary. For the purposes of preparing a robust EIA

assessment, the concrete batching plant is cumulatively assessed within the proposed extraction development where relevant in the EIAR.

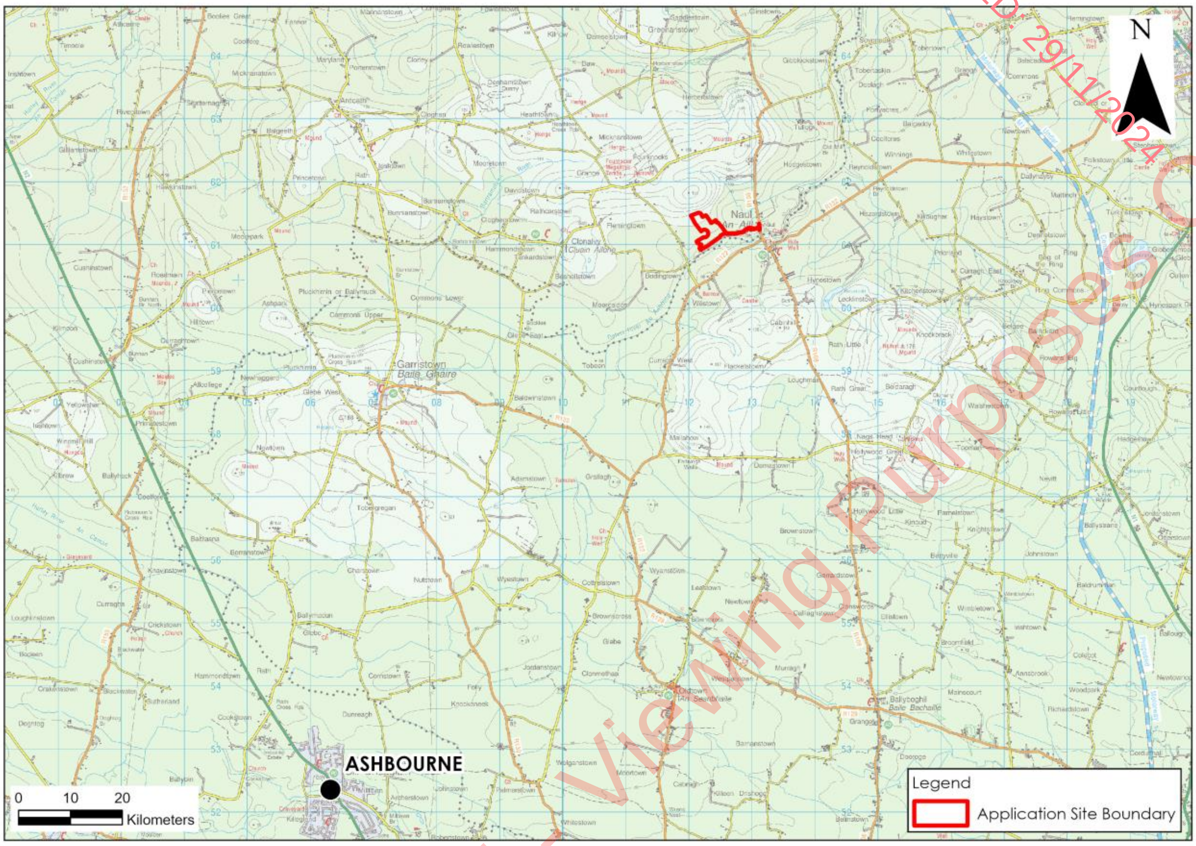

Figure A: Site Location Map

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the site and the surrounding area.

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

Regionally, the proposed development is located in the Nanny-Delvin surface water catchment within Hydrometric Area 8 of the Eastern River Basin District. More locally, the proposed development is located within Delvin_SC_010 sub catchment and Delvin_020 WFD river sub-basin. Downstream of the site the Delvin River flows through the Naul village. Meanwhile, the EPA named Fourknocks River flows to the south c. 0.3km east of the site before veering to the east. The Fourknocks River discharges into the Delvin River c. 1.1km east of the site. Downstream of this confluence, the Delvin River flows through Stamullin. The Delvin River discharges into Northwestern Irish Sea (HA 08) c. 8.5km east of the site.

A local hydrology map is shown as
Figure B below.

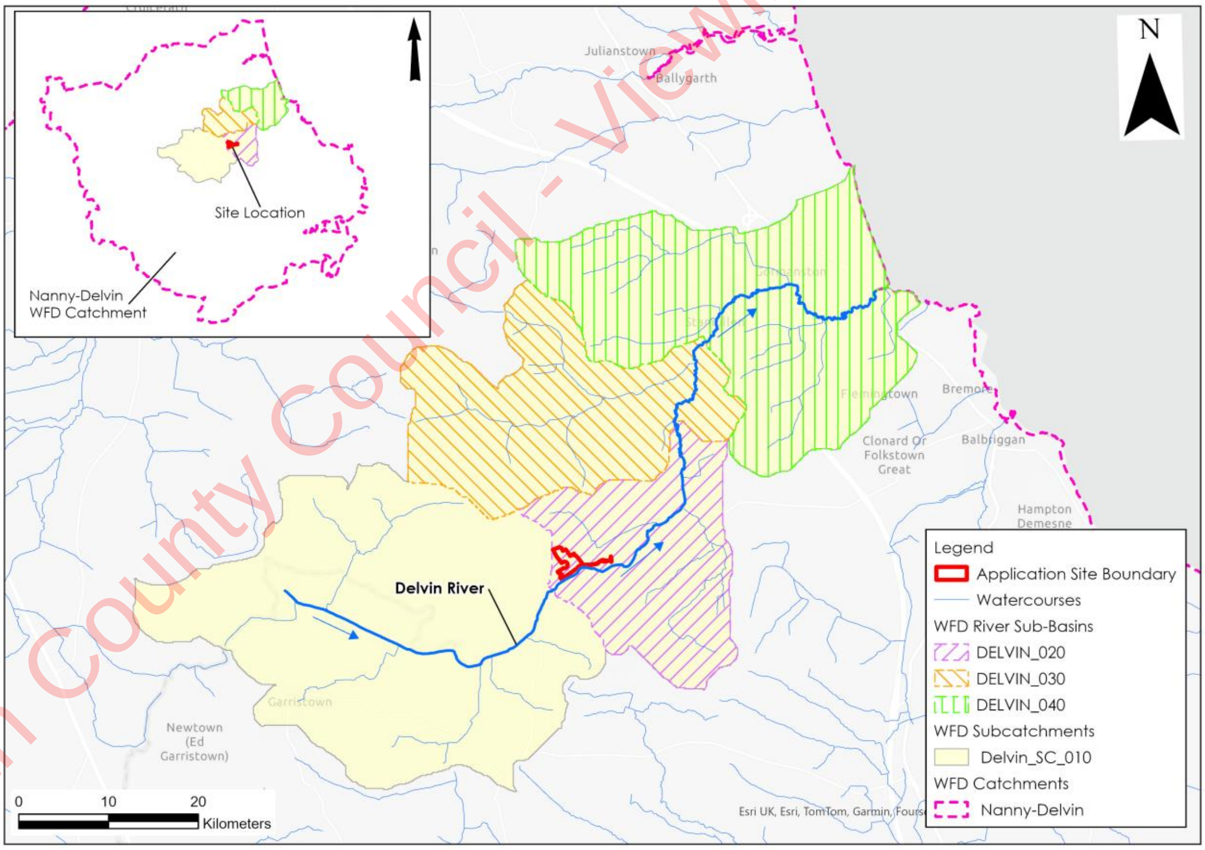

Figure B: Local Hydrology Map

3.2.2 Rainfall and Evaporation

Long term rainfall and evaporation data were sourced from Met Éireann. The 30-year annual average rainfall (1981-2010) recorded at Garristown G.S., located c.5.7km southwest of the site, is c. 846.9mm/year.

Met Éireann also provide a grid of average annual rainfall for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the average annual rainfall at the site is c. 868mm/year. This AAR is considered to be the most accurate estimate of AAR from the available sources.

In addition to average rainfall data, extreme value rainfall depths are available from Met Eireann. **Table A** below presents return period rainfall depths for the area of the proposed development. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year).

Table A: The Naul– Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.5	5.7	9.5	13.0
15 mins	5.7	9.3	15.5	21.2
30 mins	7.5	11.9	19.2	25.7
1 hours	9.7	15.1	23.6	31.2
6 hours	19.5	28.0	40.7	51.3
12 hours	25.5	35.6	50.2	62.1
24 hours	33.3	45.2	62.0	75.3
2 days	40.6	54.5	73.8	89.0

Based on groundwater recharge estimates from the Geological Survey of Ireland (GSI) map viewer (www.gsi.ie), groundwater recharge at the site ranges from 25% to 85%. The areas mapped as having lower groundwater recharge rates are situated towards the centre of the site with GSI stating that these areas contains low permeability subsoils. However, the majority of the site is mapped by the GSI as having high rates groundwater recharge due to bedrock being at or near the surface in the north of the site and due to the presence of permeable subsoils further south. An estimate of 80% groundwater recharge is taken as an average for the overall site due to the predominance of the permeable sand and gravel subsoils and the lack of any significant surface water drainage features within the site. Therefore, annual groundwater recharge and surface water runoff rates at the site are estimated to be 269mm/yr and 67mm/yr. Where vegetation and topsoil are removed for the proposed development and the bare subsoils are exposed, groundwater recharge will increase slightly (the increase will be relatively small given the existing high rates of groundwater recharge).

Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann (www.met.ie). The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation events of c.20%. In total the projected annual reduction in rainfall near the site is modelled as c. 8% under the medium-low emission scenario and c. 6% under the high emissions scenario. As stated above the local average long term rainfall data for the site is estimated to be 868mm/yr. Under the medium-low emissions scenario this may reduce to c. 799mm/yr, while under the high emissions scenario this figure may reduce to 816mm/yr.

3.3 GEOLOGY

The Teagasc soils map for the local area shows that the site is underlain by predominantly acid shallow well drained mineral soils (AminSW) with some acid poorly drained mineral soils (AminPD) further south. Some basic shallow well drained mineral soils (BminSW) are also mapped towards the south of the site. Other mapped soils in the surrounding lands include alluvium along the Delvin River, immediately to the south of the overall landholding.

The GSI mapped subsoils at the site comprise of Irish Sea Till derived from Lower Palaeozoic sandstones and shales (IrSTLPSsS) in the east and west. Bedrock outcrop or subcrop (Rck) is mapped towards the centre of the site. Meanwhile, gravels derived from Lower Palaeozoic sandstones and shales (GLs) are mapped towards the south. Other subsoils in the surrounding lands include alluvium (A) along the Delvin River along the southern boundary of the landholding. Some lacustrine sediments are also mapped c. 170m to the east of the site.

Five boreholes were drilled at the site in 2019 (refer to EIAR Chapter 6). The site investigations revealed the nature of the subsoils and the thickness of the granular deposits. The subsoils were noted to comprise of glacial till material as well as sand and gravel. The thickness of the sand and gravel varies across the site from 2.8m at BH1 in the southeast to 19.75m in BH2 towards the centre of the site.

Based on the GSI bedrock mapping (www.gsi.ie) the northern portion of the site is underlain by the Clashford House Formation while the southern portion is underlain by the Naul Formation. The Clashford House and Naul Formations are separated by a mapped fault. There are several additional faults and folds mapped in the surrounding area, and also several different bedrock geological formations. Bedrock at the site is buried beneath a significant thickness of soil and subsoils with limited bedrock exposures in the local area. The 5 no. boreholes completed at the site ranged in depth from 11.5 to 30m and did not encounter any bedrock (contrary to the GSI mapped subsoils which indicated that there was some bedrock outcrop/subcrop within the site).

3.4 DESIGNATED SITES & HABITATS

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SAC), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The site is not located within any designated conservation site, however there are downstream hydrological connections with some of the Natura 2000 sites in the region as described below:

- The Bog of the Ring pNHA (Site Code: 001204) is located c. 3.5km to the east of site. There are no surface water connections from the site to this pNHA. The Delvin River acts as a hydrological barrier between the site and the pNHA;
- Cromwell's Bush Fen pNHA (Site Code: 001576) is located c. 3.5km to the northwest of the site. There are no surface water connections between the site and this pNHA. Groundwater at the site will flow to the south towards the Delvin River;
- Knock Lake pNHA (Site Code: 001203) is located c. 5.9km to the east of the site. There are no surface water connections between the site and this pNHA. Knock Lake pNHA is located in a separate GWB to the site and the Delvin River acts as a hydrological barrier;
- The River Nanny Estuary and Shore SPA (Site Code: 004158) is located c. 8.2km to the northeast of the site. There are no surface water connections between the site and this SPA. The Delvin River discharges into the coastal waterbody to the south of this SPA;
- Laytown Dunes Nanny Estuary pNHA (Site Code: 000554) is located c. 8.2km to the northeast of the site. There are no surface water connections between the site and

this SPA. The Delvin River discharges into the coastal waterbody to the south of this SPA; and,

- The North-West Irish Sea SPA (Site code: 004236) is located c. 7.2km (Flowpath c. 11km) to the east of the site. An indirect hydrological connection exists between the site and the North-West Irish SPA via the Delvin River (and groundwater recharge and flow). The total length of the hydrological flowpath between the site and this SPA is c. 11.8km. Despite the connection between the site and the SPA, there is limited potential for effects given the length of the hydrological flowpath and the large volume of water with the coastal waterbody (i.e. Northwestern Irish Sea) within which the SPA is located.

4. SITE-SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following flood risk assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

4.2 FLOOD RISK ASSESSMENT PROCEDURE

This section of the report details the site-specific flood risk assessment carried out for the proposed development and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the development. As per the relevant guidance (DoEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment – quantitative appraisal of potential risk to a proposed development*.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding, which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;
- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,
- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Due to its inland location, coastal flooding is not applicable to the site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.

- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.

- Flooding from artificial drainage systems results when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity and the system becomes blocked, and / or cannot discharge due to a high water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.

- Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors such as tidal variations. While water level may rise slowly, it may be in place for extended periods of time. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.

- Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e. interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea tending to increase water levels inland, which may flood over river banks.

The Flood Risk Management Guidelines provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and,

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Once a flood zone has been identified for a site, the guidelines set out the different types of development appropriate to each identified zone (pg 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for through the application of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the Applicant.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes.

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.

- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land. For example, application of Development Management Justification Test would be required at a site specific level, such as for this FRA, if a Justification Test is required.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. There was no identifiable map text on local available historical 6" or 25" mapping for the study area that would identify lands that are "liable to flood" within the area and the vicinity of the site.

4.3.2 Soils Maps - Fluvial Maps

A review of the soil types in the vicinity of the site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers, deposits of transported silts/clays referred to as alluvium build up within the flood plain and hence the presence of these soils is a good indicator of potentially flood prone areas.

Based on the EPA/GSI soil map for the local area, mineral alluvium is mapped along the course of the Delvin River which is mapped immediately to the south of the overall landholding and c. 50m east of the site.

4.3.3 OPW Past Flood Events Map

To identify those areas as being at risk of flooding, OPW's indicative river and coastal flood maps (www.viewer.myplan.ie) were consulted.

The OPW Past Flood Events Maps have no records of recurring or historic flood instances within the site. The closest mapped historic flood event (Flood ID: 1698) is located to the east and downstream of the site along the Delvin River in Naul village. In relation to this flood event the local area engineer's report states that flooding occurred in the Skane Catchment on 27th December 1978, a peak level corresponding to a staff gauge reading of 1.51 m was recorded at Station 08002 Naul. Another flood event is mapped at The Square Naul Village (Flood ID: 1650) in Naul. In relation to this flood event Fingal County Meeting's report states that a pub flooded once due to runoff following heavy rainfall. Remedial works were carried out in 2004. A recurring flood event is also recorded further downstream of the site along the Delvin River in Stamullin (Flood ID: 942).

The Delvin River to the southwest and upstream of the site forms part of the Garristown and Delvin Drainage District. Drainage Districts were carried out by the Commissioners of Public Works under a number of drainage and navigation acts from 1842 to the 1930s to improve land for agriculture and to mitigate flooding. Channels and lakes were deepened and widened, weirs removed, embankments constructed, bridges replaced or modified and various other work was carried out. The purpose of the schemes was to improve land for agriculture, by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows.

Historic and recurring flood events in the vicinity and downstream of the Site are shown on **Figure C** below.

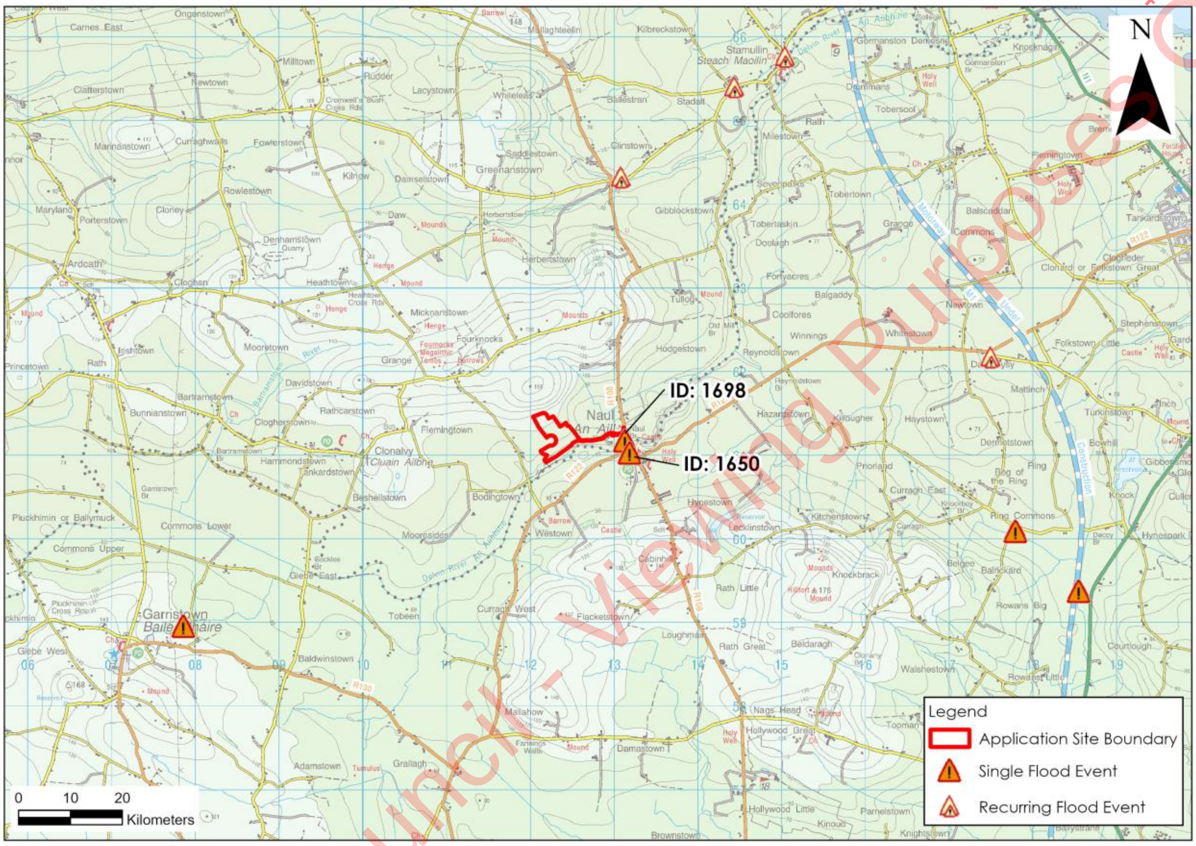

Figure C: OPW Past Flood Events Map

4.3.4 GSI Winter 2015/2016 Surface Water Flood Mapping

The GSI Winter 2015/2016 Surface Water Flooding map shows fluvial (rivers) and pluvial (rain) floods, excluding urban areas, during the winter 2015/2016 flood event, which was the largest recorded flood event in many areas. This surface water flood map is available to view at www.floodinfo.ie.

The GSI do not record any historic surface water flood zones in the area of the site. The nearest Winter 2015/2016 Surface Water Flooding mapped areas are located c. 1.86km to the southeast of the site (refer to **Figure D**).

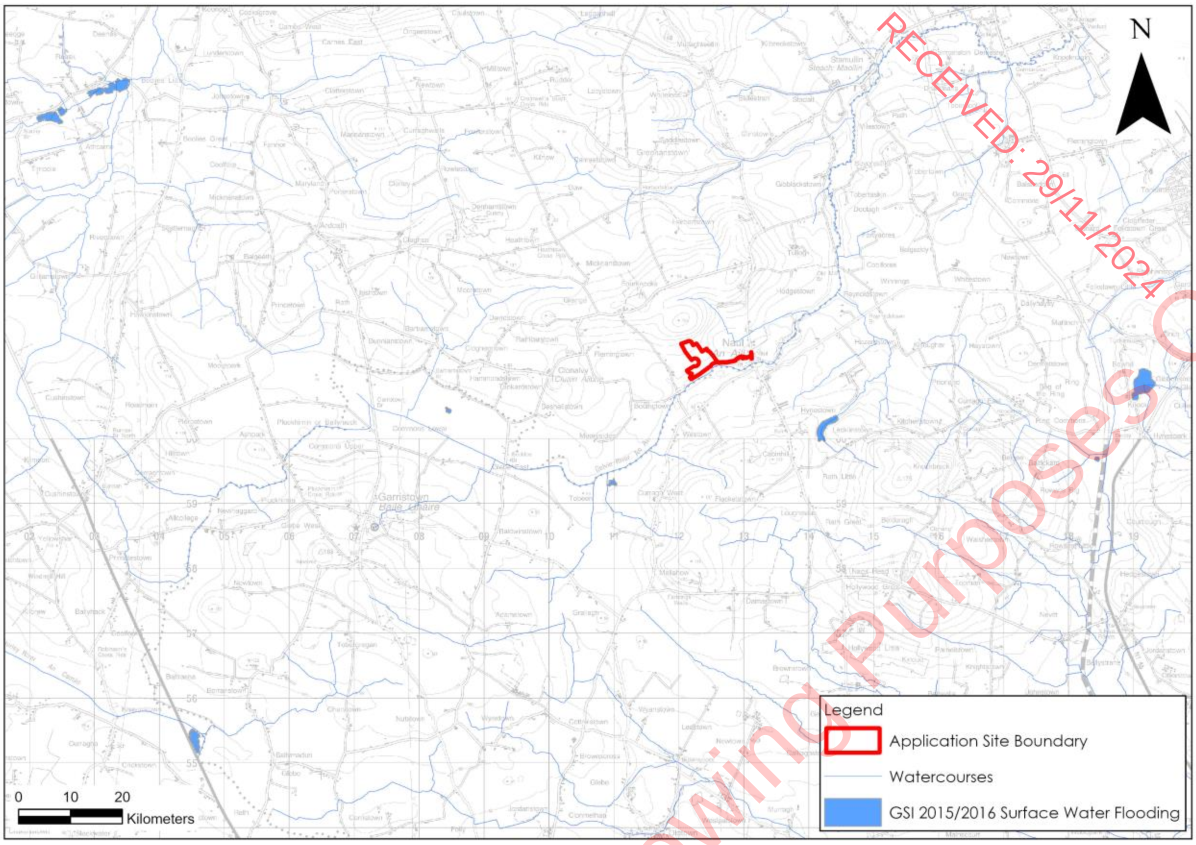

Figure D: GSI 2015/2016 Flood Mapping

4.3.5 CFRAM Mapping

Where complete, the Catchment Flood Risk Assessment and Management (CFRAM)[1] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the previous PFRA maps. CFRAM mapping of river flood extents are available at www.floodinfo.ie.

No CFRAM fluvial flood zones encroach upon the site. The closest CFRAM flood zones are located along the Delvin River c. 50m to the south of the site and immediately to the south of the overall landholding. In the vicinity of the site, the modelled CFRAM fluvial flood zones do not extend any significant distance from the river channel and do not indicate the presence of a floodplain.

[1] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

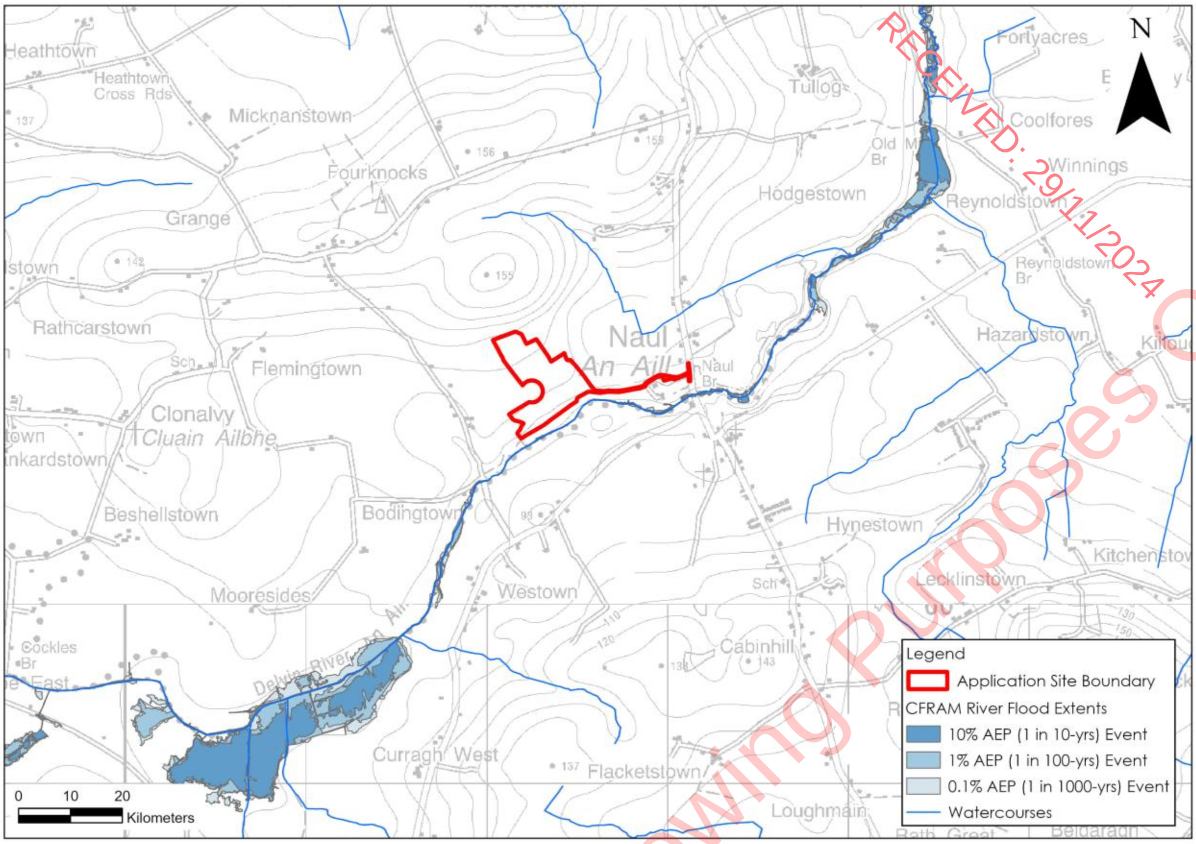

Figure E: CFRAM Fluvial Flood Mapping

4.3.6 National Indicative Fluvial Flood Mapping

The National Indicative Fluvial Flood Mapping (NIFM) (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme.

The Present Day Scenario has been generated using methodologies based on historic flood data and does not consider the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.3.9** below.)

For the Present Day Scenario, the closest mapped low (1 in 1,000-year) and medium (1 in 100-year) probability fluvial flood zones are located c. 2.9km to the north of the site. No NIFM flood zones are located in the vicinity of the site.

4.3.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the site or in the surrounding lands.

4.3.8 Coastal Flooding

The site is located c. 9.3km west (straight line distance) from the coast and at an elevation of between c. 67 and c. 110mOD. Therefore, there is no risk of coastal flooding at the site.

4.3.9 Climate Change

It is likely that climate change will have significant impacts on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall. The CFRAM Programme has modelled flooding associated with potential future climate change scenarios. These CFRAM flood zones have been modelled for 2 no. potential future climate change scenarios, with the Mid-Range and High-End Future Scenario flood extents generated using an increase in rainfall of 20% and 30% respectively.

The modelled CFRAM River flood extents for the Mid-Range and High-End Scenarios show similar flood zones along the Delvin River to the Present Day Scenario as described above in **Section 4.3.5**.

There are no NIFM fluvial flood zones in the vicinity of the site.

Therefore, flood zones at the site are unlikely to be significantly impacted by future climate change.

4.3.10 Summary – Flood Risk Identification

Based on the information gained through the flood identification process, the site is not constrained by coastal, fluvial or groundwater flooding. The site is located in Fluvial Flood Zone C and is at a low risk of flooding. Fluvial flood zones are mapped in the vicinity of the Delvin River to the south of the overall landholding but do not encroach upon the site.

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Site Survey and Drainage

Detailed walkover surveys of the site were undertaken by Michael Gill of HES on 16th March 2023, 27th June 2024 and 16th July 2024.

The site is used for tillage and was ploughed and planted during the various site visits. The main extraction area is accessed via an existing farmyard.

There are 2 no. open drainage ditches within the site, along existing field boundaries and hedgerows which direct surface water runoff to the Delvin River. The main drainage ditch is located along the existing hedgerow boundary to the west of Phase 1 where it turns 90 degrees to the east before turning 90 degrees south and runs along the field boundary between Phases 2 and 3, and discharges into the Delvin River. A smaller northeast to southwest orientated drainage ditch is located between Phases 1 and 2, and discharges into the main drainage ditch before it veers to the south. These drainage ditches are typically dry and only respond to high rainfall events. The vast majority of rainfall falling at the site recharges to ground.

4.4.2 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the site can be described using the Source – Pathway – Receptor Model ("S-P-R"). Given the highly permeable nature of the subsoils at the site and the lack of any significant surface water drainage features, the potential for pluvial flooding is generally low. The fluvial flood risk is also very low as no fluvial flood zones encroach upon the site. There is no risk of groundwater or coastal flooding at the site.

4.4.3 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it would appear that flooding is unlikely to be problematic at the site. The potential sources of flood risk for the Site are outlined and assessed in **Table B**.

Table B: S-P-R Assessment of Flood Sources

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the Delvin River	Land & infrastructure	Based on CFRAM and NIFM mapping, the site is located in Fluvial Flood Zone C where there is a low risk of fluvial flooding. Due to the highly permeable subsoils at the site and the lack of any significant surface water drainage features, there is no risk of fluvial flooding.
Pluvial	Ponding of rainwater on site	Land & infrastructure	Within the site there is little risk of pluvial flooding due to the highly permeable nature of the subsoils at the site and the lack of any significant surface water drainage features. Rainfall readily recharges to ground at the site.
Surface water	Surface ponding/ Overflow	Land & infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land & infrastructure	There are no historic or modelled groundwater flood zones located

			within the site. Some extraction works are proposed below the groundwater table. However, due to the sloping nature of the site, the amended pit floor levels and the highly permeable subsoils, the sands and gravels will continue to drain freely to the south.
Coastal/tidal	Overbank flooding	Land, People, property	The site is located inland and stands at a significant elevation above sea level. Therefore, there is no risk of coastal/tidal flooding.

4.5 REQUIREMENT FOR A JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test[2] is shown in **Table C** below.

It may be considered that the proposed development can be categorised as "Less Vulnerable Development" as it comprises of mineral working and processing. The proposed development is located in Flood Zone C (Low risk) and can therefore be considered as appropriate from a flood risk perspective. No Justification Test is required.

Table C: Matric of Vulnerability versus Flood Zone

	Flood Zone A	**Flood Zone B**	**Flood Zone C**
Highly vulnerable development (including essential infrastructure)	Justification test	Justification test	Appropriate
Less vulnerable development	Justification test	Appropriate	**Appropriate**
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: *Taken from Table 3.2 (DoEHLG, 2009)*
Bold: *Applies to this project.*

[2] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

5. FLOOD IMPACT ASSESSMENT

5.1 CONCERN REGARDING FLOOD RISK ASSOCIATATED WITH PREVIOUS APPLICATION

Kilsaran previously applied for planning permission for sand and gravel extraction at this site in 2019. Following a Request for Further Information (RFI) An Bord Pleanála refused this permission in 2021.

One of the concerns regarding the previous application was the potential impact on downstream flooding. The Inspector's Report stated that:

> *"As stated in the EIAR and as evidenced by the OPW's data on flood events and flood risk, there is no history of flooding in the immediate vicinity of the appeal site. However, Naul bridge is associated with flood events and it is stated in the EIAR that the loss of surface layers could increase groundwater recharge and an increase in base flows in the River Delvin and risk of flooding at Naul (section 7.165). The risk of increased base flows in the river of is stated to be a 'likely' effect of the development (Table 7-9 EIAR), with the effect discounted to 'slight' having regard to the 'low attribute quality' of the River. There is no explanation of how the discounting has been arrived at or how the proposed development may influence the frequency or extent of flooding. This omission is significant, in particular given the stated vulnerability of the proposed development to the effects of climate change referred to above."*

5.2 PROPOSED WATER MANAGEMENT

5.2.1 Surface Water Runoff

Rainfall across the extraction areas will percolate naturally to the ground as diffuse groundwater recharge and this is a standard water management measure in sand and gravel pits. The rainfall percolates naturally to the groundwater as is the current situation at the existing greenfield site. The storm runoff will be contained within the working areas and the water may be used for site operations as required.

During extreme storm events surface water runoff across the working areas will be managed before the water infiltrates to ground; storm water management during extreme weather events is a standard requirement in the operation of sand and gravel pits. Kilsaran operate numerous sand and gravel pits across the country and have many years of experience in the management of storm water at their sites.

Storm water runoff may pond on the pit floor on a temporary basis prior to the water infiltrating naturally to the ground; however, no specific site measures or infrastructure are required for the management of this storm water within the pit prior to infiltration to the ground and draining to the south.

5.2.2 Interaction with the Existing Drainage Ditches

As described above, there are 2 no. open drainage ditches within the site which direct surface water runoff from the existing agricultural lands to the south and into the Delvin River. These drains are typically dry and only contain water during and after high rainfall events.

2 no. sections of the drainage ditches will require removal over the course of the proposed development. Firstly, a section of the ENE to WSW orientated ditch will be removed as extraction advances from Phase 1 to Phase 2. The main drainage ditch, oriented NW to SE,

which runs through the centre of the site will remain in place for the duration of extraction operations in Phases 1 and Phase 2. A section of this main drainage ditch will be removed as extraction advances from Phase 2 to Phase 3. During Phase 3 extraction operations and following final restoration, the main drainage ditch will be directed to the pit floor where water will percolate to ground.

Prior to removal, all existing ditches will be blocked 10m downstream of the proposed extraction area extends. Once blocked the residual ditches will not act as a pathway for site drainage to get to the Delvin River. The only pathway will be via groundwater flow within the sand and gravel deposits.at the southern end of

5.2.3 Flood Impact Assessment

There will be no direct discharge to surface waters during the operational phase of the proposed development. Therefore, the proposed development has no potential to directly effect the downstream flood risk.

An indirect hydrological connection exists between the site and the Delvin River. This connection is associated with groundwater recharge and the lateral migration of shallow groundwater within the sand and gravel subsoils at the site. The increase in groundwater recharge due to the removal of soil and subsoil across the site could result in a very small increase in baseflow contribution from groundwater to the Delvin River.

Table D below presents a quantification of the changes in groundwater recharge associated with the proposed development. The quantitative analysis assumes that the baseline groundwater recharge at the site is currently c. 269mm/year (80% of the Effective Rainfall). In the existing baseline scenario, the total average volume of groundwater recharge across the proposed extraction area (6.2ha) is c. 45m^3/day. For the purposes of a conservative assessment it is assumed that 100% of the precipitation falling within the extraction area will recharge to ground. This equates to 57m^3/day across the extraction area and represents a 25% increase in recharge from the baseline scenario.

Table E also compares the baseflow volumes from the proposed extraction areas to the baseline flow and flood volumes in the Delvin River, assuming that all groundwater recharge will discharge as baseflow. These calculations have been completed for a range of subsoil permeabilities to account for the natural vertical and lateral variation in the glacial subsoils. The assessed permeabilities range from 1x10^{-4}m/s for clean sands and gravels to 1x10^{-6}m/s for a mixture of sands and silts. For these scenarios the baseflow will range from 1,440 to 14.4m^3/day. These baseflow volumes equate to a very small proportion of the overall flow in the Delvin River. The modelled Q1 flow (flow that is exceeded 1% of the time) at the EPA Hydrotool Node 08_314 is 2.694m^3/s. Even in a worst-case scenario whereby all of the subsoils at the site consist of clean and permeable sand and gravels, the baseflow to the Delvin River represents less than 1% of the Q1 flow volume in the River. Note that the 1 in 100-year and 1 in 1,000-year flood volumes will be significantly larger than the Q1 flow in the Delvin River.

Furthermore, the storm-water, which was formerly conveyed downstream by these field ditches during high intensity rainfall events, will be discharged onto the pit floor and will have to migrate through the underlying subsoil sand and gravels prior to discharge to the river as baseflow. This will have a positive effect on downstream flood risk.

Therefore, given the baseline hydrogeological regime (characterised by high rates of groundwater recharge and low rates of surface water runoff), the lack of any proposed surface water discharge, the small, proposed extraction area (6.2ha) in comparison with the total catchment area of the Delvin River, the proposed development will not significantly alter runoff or recharge rates and there will be no discernible impact on the downstream flood risk.

The pre-mitigation effect is considered to be an indirect, negative, imperceptible, medium-term, likely effect on surface water quantity.

Table D: Quantification of Change in Groundwater Recharge Volumes

Scenario / Recharge Rates	GSI Baseline Scenario (80% GW Recharge)	Proposed Development Scenario
Effective Rainfall (mm/yr)	336	336
Groundwater Recharge (mm/yr)	269	336
Extraction Area (ha)	6.2	6.2
Total Recharge across Extraction Area (m^3/day)	45	57

Table E: Quantification of Changes in Baseflow in Relation to Flood Flow Volumes in the Delvin River

Subsoil Permeability	$1x10^{-4}$ (m/s)	$1x10^{-5}$ (m/s)	$1x10^{-6}$ (m/s)
$Q_{Baseflow}$ (m^3/day)	1,440	144	14.4
$Q_{Baseflow}$ (m^3/s)	0.0166	0.0016	0.0001
Q_1 Delvin River (m^3/s)	2.694	2.694	2.694
$Q_{Baseflow}$ as a % of Q_1	0.6%	0.005%	0.004%

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the proposed development at The Naul, Co. Meath. From this study:
  - No instances of historical flooding were identified in historic OS maps;
  - No instances of recurring or historic flooding were identified on OPW maps within the site;
  - The GSI Historical 2015/2016 flood map does not record any historic flood zones in the area of the site;
  - The site is not mapped within any historic or predictive groundwater flood zone;
  - The site is not identified as being within CFRAM Flood Zones; and,
  - The National Indicative Fluvial Food Mapping does show some fluvial flood zones in the area of the site.
- CFRAM fluvial flood zones are mapped along the Delvin River to the south of the overall landholding and c.50m south of the site. These modelled fluvial flood zones do not encroach upon the site and do not extend any significant distance from the river channel, i.e. the Delvin River south of the site flows within an incised channel, and as a result there is no significant floodplain along the River;
- During the walkover surveys, a lack of surface water drainage features was recorded within the site. The existing surface water drainage network within the site comprises of 2 no. manmade field ditches which only contain water following intense rainfall events;
- The majority of rainfall falling at the site recharges to ground and discharges to the Delvin River as baseflow;
- The proposed development does not include any surface water discharge;
- The proposed development will not significantly alter the local hydrogeological regime which is characterised by low rates of surface water runoff and high rates of groundwater recharge;
- The only potential for the proposed development to contribute to downstream flooding is via an increase in groundwater recharge at the site, and an associated increase in baseflow to the Delvin River. However, a quantitative analysis has shown that any increased baseflow component from the site represents an insignificant percentage of the total flows in the Delvin River; and,
- Therefore, the potential for the proposed development to impact on downstream flooding is negligible.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
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Cunnane & Lynn	1975	Flood Estimated Following the Flood Studies Report
Cawley, A.	1990	*The Hydrological Analysis of a Karst Aquifer System.* B.E., National University of Ireland.
CIRIA	2004	Development and Flood Risk – Guidance for the Construction Industry.
OPW	Not Dated	Construction, Replacement or Alteration of Bridges and Culverts. A Guide to Applying for Consent under Section 50 of the Arterial Act, 1945.
Institute of Hydrology	1994	Flood Estimation in Small Catchments.
Fitzgerald & Forrestal	1996	Month and Annual Averages of Rainfall for Ireland 1961 – 1990.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.

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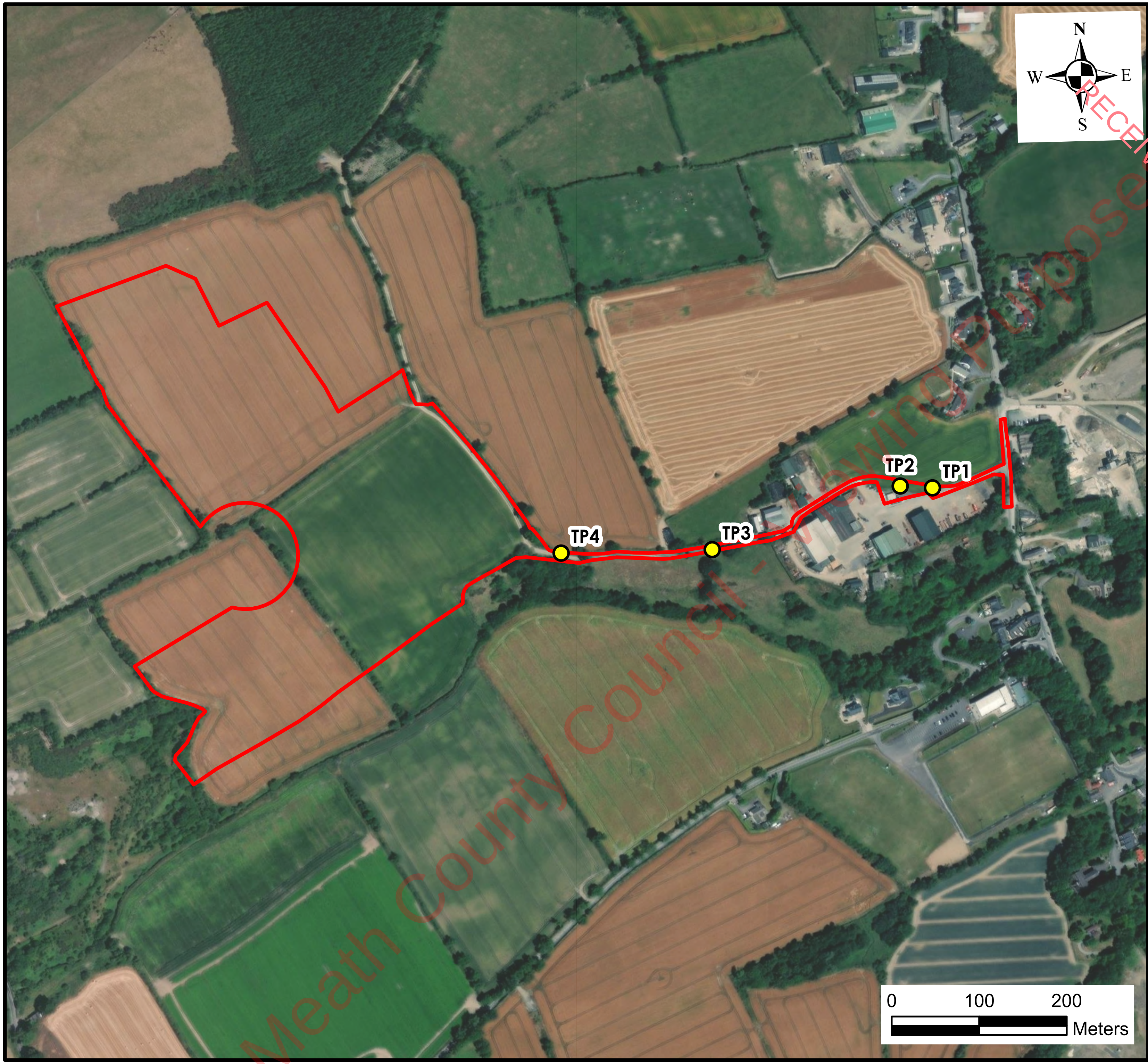
Appendix 7-I

Internal Access Track Site Investigation



Legend

Application Site Boundary

Trial Pit Locations

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
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fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: Kilsaran Concrete

Job: Naul, Co. Meath

Title: Access track Site Investigation Map

Figure No: Appendix 7-I

Drawing No: P1703-0-1124-A4-Appendix7-1-00A

Sheet Size: A4 | Project No: P1703-0

Scale: 1:6,000 | Drawn By: GA

Date: 29/11/2024 | Checked By: MG

Trial Pit Log

Project No: P1703-0
Site: The Naul, Co. Meath
Client: Kilsaran Concrete Unlimited Company

Date started: 23/10/2024
Date finished: 23/10/2024

Trial Pit No: TP1
Easting: 313037.96
Northing: 261250.33
Elevation: ~71.8mOD

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
		71.80	Ground Surface			
0.00		0.00 / 71.65	Topsoil			
		0.15 / 71.00	Firm, dry, dark brown, slightly gravelly SILT/CLAY with cobbles			
		0.80 / 70.80	Firm, dark brown, gravelly SILT/CLAY with cobbles			
1.00		1.00				

Remarks: Infiltration test completed, k = 9.6 x 10^{-5} m/s

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1

Trial Pit Log

Project No: P1703-0
Site: The Naul, Co. Meath
Client: Kilsaran Concrete Unlimited Company

Date started: 23/10/2024
Date finished: 23/10/2024

Trial Pit No: TP2
Easting: 313001.07
Northing: 261252.44
Elevation: ~72.0mOD

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
		72.00	Ground Surface			
0.00		0.00 / 71.85	Topsoil			
		0.15 / 70.90	Firm, dry, dark brown SILT/CLAY with occasional cobbles			
1.00		1.10				

Remarks: Infiltration test completed, k = 2.0 x 10^{-5} m/s

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1

Trial Pit Log

HYDRO-ENVIRONMENTAL SERVICES

Project No: P1703-0
Site: The Naul, Co. Meath
Client: Kilsaran Concrete Unlimited Company

Date started: 23/10/2024
Date finished: 23/10/2024

Trial Pit No: TP3
Easting: 312786.24
Northing: 261179.74
Elevation: ~71.4mOD

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
0.00		71.40	Ground Surface			
		0.00	Topsoil			
		71.25 0.15	Firm, dry, orange brown, slightly gravelly SILT - SILT/CLAY			
1.00		70.40 1.00				

Remarks: Infiltration test completed, k = 3.5 x 10^{-5} m/s

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1

Trial Pit Log

Trial Pit No: TP4

Project No: P1703-0
Site: The Naul, Co. Meath
Client: Kilsaran Concrete Unlimited Company

Date started: 23/10/2024
Date finished: 23/10/2024

Easting: 312613.54
Northing: 261175.77
Elevation: ~75.3mOD

SUBSURFACE PROFILE

Depth	Symbol	Depth/Elev.	Description	Water Strikes	Sample Type	Comments
		75.03	Ground Surface			
0.00		0.00 / 74.88	Topsoil			
		0.15 / 74.03	Very firm, dry, orange brown, SILT/CLAY with occasional cobble			
1.00		1.00				

Remarks: Infiltration test completed, k = 2.3 x 10^{-5} m/s

Contractor:
Excavator type:
Logged by: DB

Scale as shown
Sheet: 1 of 1